Province of British Columbia
Ministry of Energy, Mines and
Petroleum Resources

MINERAL RESOURCES DIVISION
Geological Survey Branch

MAGNETITE OCCURRENCES IN BRITISH COLUMBIA

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SUMMARY

Magnetite is ubiquitous to most rocks in the crust. It is most common in basic to ultrabasic and metamorphic rocks as a primary phase, and is often found in sedimentary rocks as a trace or minor component. Magnetite is found in several types of mineral deposits in British Columbia. The most common is skarns in which magnetite varies from the main component to a trace mineral. Iron skarns are common and often large, such as the Tasu deposit on the Queen Charlotte Islands, which produced over 20 million tonnes of iron ore. Other types of magnetite occurrences are usually smaller; they include differentiated magmatic, stratabound, ultramafic and placer deposits. From a production standpoint, only the skarn bodies have been mined in the past.

Historically, magnetite was produced as an iron ore with the greatest production period in the 1950's and 1960's. Major producers included the Texada Island iron mines, the Brynnor mine at Kennedy Lake, and the Jedway iron mine on South Moresby Island. Most recently, Wesfrob Mines Ltd. produced iron ore from the Tasu deposit, South Moresby Island. It closed in 1984 and since then there has been no magnetite mined in British Columbia. At present, magnetite is currently produced from a stockpile at the now closed Craigmont mine near Merritt. All of this magnetite is used in the coal processing plants of British Columbia and as the supply is limited, a new source of magnetite will be required.

Magnetite has been long overlooked as a secondary economic mineral. Only the high grade orebodies have been mined. It is readily separated from other ores by simple methods and is easy to process. The best example is the Craigmont mine where the primary ore was chalcopyrite but now the magnetite tailings are providing continued income for the operators.

Skarn deposits provide the greatest potential source of magnetite in B.C.. The west coast of Vancouver Island and the Queen Charlotte Islands, the Greenwood - Deadwood and Rossland mining camps have the largest number of recorded magnetite occurrences. As well, several iron mines closed before their ore reserves were exhausted and many copper and base metal mines discarded magnetite with the mill tailings. These are potential magnetite sources as the infrastructure is still present or readily available (ie. roads, water, power).

Magnetite is an iron oxide which belongs to the spinel group. The chemical formula is : $Fe^{3+} (Fe^{2+} , Fe^{3+})_2 O_4$ or Fe_3O_4 . It is a black, dense, hard metallic mineral whose crystalline form is octahedral or, less commonly, dodecahedral. The distinguishing features of magnetite are its density (5.18 gm. / cubic cm.) and its strong magnetism. Magnetite often contains small amounts of titanium or manganese. Aluminum, magnesium, and chromium are also found in trace amounts. At surface conditions, magnetite is quite stable and oxidizes very slowly to hematite (Fe_2O_3).

This report documents 81 significant magnetite occurrences in British Columbia. There are many more but these are the best documented in the available literature and ministry files.

INTRODUCTION

Purpose and Scope of Report

The purpose of this report is to provide comprehensive information on significant magnetite occurrences in British Columbia. Included in the report is information on the location, geology, size, quality, and history of the occurrences.

A total of 640 known magnetite occurrences were reported in the B.C. Ministry of Energy, Mines, and Petroleum Resources MINFILE data base as of July, 1987. Available information on each occurrence was screened and evaluated according to four general classifications. These are Past Producers, "A" Prospects, "B" Prospects and Showings. From the total database, 81 significant occurrences are described. This includes all of the first three classes and a selected few examples of the fourth class in order to provide the most comprehensive documentation of deposit types. These occurrences have been grouped by genetic origin to provide a complete presentation of the types of magnetite deposits in British Columbia.

Information Proviso

The initial bibliography of magnetite occurrences was supplied by the MINFILE data base. Primary sources of information are B.C. Ministry of Energy, Mines, and Petroleum Resources annual reports, bulletins, papers, open files ; Geological Survey of Canada memoirs, summary reports, papers ; CANMET reports, company property reports and maps, assessment reports, unpublished university thesis, and some personal communications.

Because original documents have been extensively quoted, imperial units have been retained with the metric conversions added in brackets.

This report has been compiled without the benefit of associated fieldwork. Therefore any corrections or updates of information on known or new occurrences would be gratefully accepted by the B.C. Ministry of Energy, Mines, and Petroleum Resources, Geological Survey Branch.

Classification of Magnetite Deposits

PAST PRODUCER : These are occurrences which have been actively mined and magnetite was either a primary or secondary product.

A - PROSPECT : These are occurrences which have one or more of the following :

a) drilled reserves with magnetite as either primary or secondary mineralization ;

b) surface and / or underground workings which delineate zones of magnetite mineralization, commonly several hundreds of square metres at or near the surface.

B - PROSPECT : This classification includes properties that have had only small amounts of surface work, possibly one or two drill holes or short prospecting adits. In this classification little is known about the geology and the total size of the mineralized zone has been only crudely delineated.

SHOWING : This classification includes all properties where little is known about the geology or magnetite mineralization. Typically, magnetite is reported but no qualification of the amount or quality is given. Frequently only natural outcrops are present and no surface work has been done.

Because this report is based soley on available literature, this classification scheme is not intended to indicate the economic value of any deposit. Often the target of mineral exploration was for metals other than iron so that the magnetite portion frequently was ignored by the exploration geologists.

Uses and Specifications

Magnetite has several industrial uses. The primary use in western Canada is as a heavy medium for coal separation purposes. Other uses are as iron ore, lodestones (historic) and, when amalgamated with corundum (Al_2O_3) , as an abrasive known as emery. At present Craigmont Mines of Merritt, B.C. is the only producer of magnetite in the province. The present demand for magnetite in the province is approximately 50,000 tonnes per year. Also, the Craigmont mine supplies an American coal processing plant in Washington state with magnetite. In 1981, the mine also supplied 56,000 tonnes of magnetite to Australian coal processing plants. (Kilborn Engineering, 1986) The present price of magnetite concentrate at the supplier is 40 to 50 dollars per metric tonne. The cost of shipping in B.C., typically by truck for an approximate average distance of 800 kilometres, is 40 to 50 dollars per metric tonne. Therefore, coal plants are paying about 80 to 100 dollars per metric tonne of magnetite concentrate. Present suppliers reserves are very limited and a new source will be required in the forseeable future.

The use of magnetite in local coal processing plants in B.C., as well as the United States and Australia, involves using a slurry of magnetite and water of a controlled density to separate low ash coal from waste rock. Due to the bouyancy properties of solids in a fluid medium, low ash coal floats on the medium and waste rock sinks to the bottom. The `floats' and `sinks' are treated separately to recycle magnetite which becomes entrained with them. Recovery is not complete and so lost magnetite must be continually replaced to maintain the heavy medium slurry. The loss of magnetite during this process leads to the continuing demand to maintain the quantity and density of the slurry. Magnetite is preferred as the heavy medium because of its high magnetic susceptability with respect to coal for the recycling process. As well, magnetite is chemically inert in the process. The density of magnetite allows a heavy medium to be effectively produced, which greatly speeds up the process of coal separation.

Magnetite used by the coal industry must meet the following physical and chemical standards :

Grain Size:	max. 5 % by wt. > 45 micrometres (325 mesh ; ASTM) max. 30 % by wt. < 10 micrometres
Density :	4.9 to 5.2 gm. / cubic cm.
Magnetic Content :	> or = 95 % by wt.
Moisture Content :	< 10 % (when shipped) .

These criteria are the most general for the raw feed needed in the heavy media separation process. Custom milling and benefaction are preferred, as a more uniform feed tailored to the specific floatation circuit used greatly improves process effciency and magnetite recovery. (Kilborn Engineering, 1986)

Common Exploration Techniques and Mineral Processing

The most common method of detecting magnetite is by airborne and ground magnetometer geophysical survey. Frequently geophysical anomalies of 10,000 gammas (10,000 nanoTeslas) above background levels are reported over magnetite bodies. As well, pulse electromagnetic surveys and induced polarization surveys have proven effective methods of detecting magnetite rich bodies, especially in association with sulphides (Beck, 1981). In the field, hand magnets provide the best prospecting identification.

The high magnetic susceptability of magnetite allows simple separation of it from other ores and waste rock. Commonly, wet or dry drum magnetic separators are used. Further classification of wet magnetite fines after milling has been achieved by cyclone separation (Kilborn Engineering, 1986). A complete description of magnetite processing is available in the cited Kilborne Engineering reference.

Observations

During the course of preparing this paper several points common to many magnetite occurrences were observed. These are not proven specifically, however they may be useful with respect to exploration or economic evaluation of magnetite deposits. These observations are listed as follows :

A) Skarn deposits account for the greatest volume of magnetite mineralization and therefore are the best documented deposits.

B) The largest iron skarns, on Vancouver and Queen Charlotte Islands, are replacements of volcanic strata adjacent to limestone units. Often the limestones have only been recrystallized and do not host any significant mineralization.

C) The proportion of magnetite to sulphides increases in skarns associated with mafic intrusions. Most iron skarns are associated with more mafic intrusions compared, for example, with tin - molybdenum skarns which are generally related to granitic plutonism.

D) Precious metal content commonly decreases sharply with an increase in the amount of magnetite. However, precious metal content locally increases with copper enrichment.

E) The most significant iron skarns are found on the west coast of Vancouver Island. The contact of the Karmutsen volcanic package and the Quatsino limestones hosts the largest number of iron skarns.

F) Magnetite is a subsidiary component in many mines, for example asbestos, copper and base metal mines. The tailings of these mines could be an important source of magnetite. Many mines had magnetite concentrations on the order of 10 percent, such as the Cassiar, Granduc or Phoenix mines. Also mines like the Oro Denoro produced copper and gold from part of the mineralized zone and did not develop the iron portion as it was not of sufficient grade for direct shipping ore in the early part of this century.

G) Several iron mines closed before reserves were exhausted for reasons beyond the control of the mine. As a result large tonnages of high grade material still remain in place.

H) There is potential for Banded Iron Formations (BIF's) in B.C.. One such prospect north of MacKenzie, the Falcon property, is discussed later in this paper. The largest iron mines (magnetite and hematite) in Canada are hosted in Precambrian BIF's.

Tailings as Potential Sources of Magnetite

Tailings of old and current mines are probably the best readily available source of magnetite in the province. The present production is from a large tailings pile at the Craigmont mine. The mine worked a copper skarn that contained appreciable magnetite. It was stockpiled during the middle portion of the life of the mine and was sold during the later years of the mining operation.

There are several other mines in the province which had large amounts of magnetite in the ore that was discarded with the mill waste. The high grade copper ore of the Phoenix mine contained over 16 percent magnetite. Only a small fraction of the magnetite in the 25 million tonnes of raw ore mined at the Phoenix camp was shipped with the copper ore for fluxing purposes. Other examples of mines that discarded magnetite with the mill waste include Granduc and Cassiar. The ore at Granduc contained about 12 percent magnetite and the asbestos ore at the Cassiar mine contains about 9 percent magnetite.

One of the most significant points about potentially developing tailings piles is the preexisting infrastructure. Roads, water supply, power and the like still exist or can be readily reintroduced. This is one of the points that could make tailings a most attractive prospect.

Carbonatites as a Potential Source of Magnetite

Several carbonatite bodies are known in British Columbia. They are polymineralic bodies that contain a wide variety of unusual minerals. These deposits are best known as sources of rare earth elements [Lanthanide series elements (atomic numbers 57 to 71 inclusive)], as well as niobium, yttrium, thorium, and scandium. Pell (1987) describes carbonatites as " Ultrabasic igneous rocks composed of 50 percent carbonate minerals. They may contain significant amounts of olivine, magnetite, pyroxene, sodic amphibole, biotite, vermiculite, apatite, zircon, columbite, rare earth carbonate minerals, and pyrochlore. Carbonatites occur most commonly as intrusive bodies, generally associated with other alkaline igneous rocks. ".

Magnetite is a common constituent of most carbonatites. However the magnetite is usually only one or two percent of the total volume of the body. The magnetite often occurs as small pods and lenses scattered throughout the carbonatite. The magnetite could readily be produced as a secondary mineral to the REE's, similar to the Palabora Carbonatite Complex in the Republic of South Africa.

The largest carbonatite bodies in B.C. are the Aley, 140 kilometres north northwest of MacKenzie which is staked by Cominco Ltd. as a niobium prospect, and the Ice River Complex, the majority of which is in Yoho and Kootenay National Parks. Many other carbonatites and related complexes are recorded and the reader is referred to Pell (1987).

GENERAL REFERENCES

Beck, A.E. ; 1981 ; Physical Principles of Exploration Methods ; The Macmillain Press Ltd.

Guilbert, J.M. and Park, C.F. ; 1986 ; The Geology of Ore Deposits ; W.H. Freeman and Company

Kilborne Engineering ; 1986 ; Characteristics of Canadian Magnetite for Optimum utilization of Coal in Heavy Media Processes ; Energy, Mines and Resources : CANMET , Edmonton Coal Research Laboratory : Volume 1 ; Report on Survey of Magnetite Medium Usage in Heavy Media Coal Cleaning : Volume 2 ; Report on Plant Procedures and Magnetite Testing and Analysis ; Kilborne Project N$^{o.}$ 7814 - 15

Pell, J. ; 1987 ; Alkaline Ultrabasic Rocks in British Columbia: Carbonatites, Nepheline Syenites, Kimberlites, Ultrabasic Lamprophyres and Related Rocks ; BCMEMPR Open File 1987 - 17

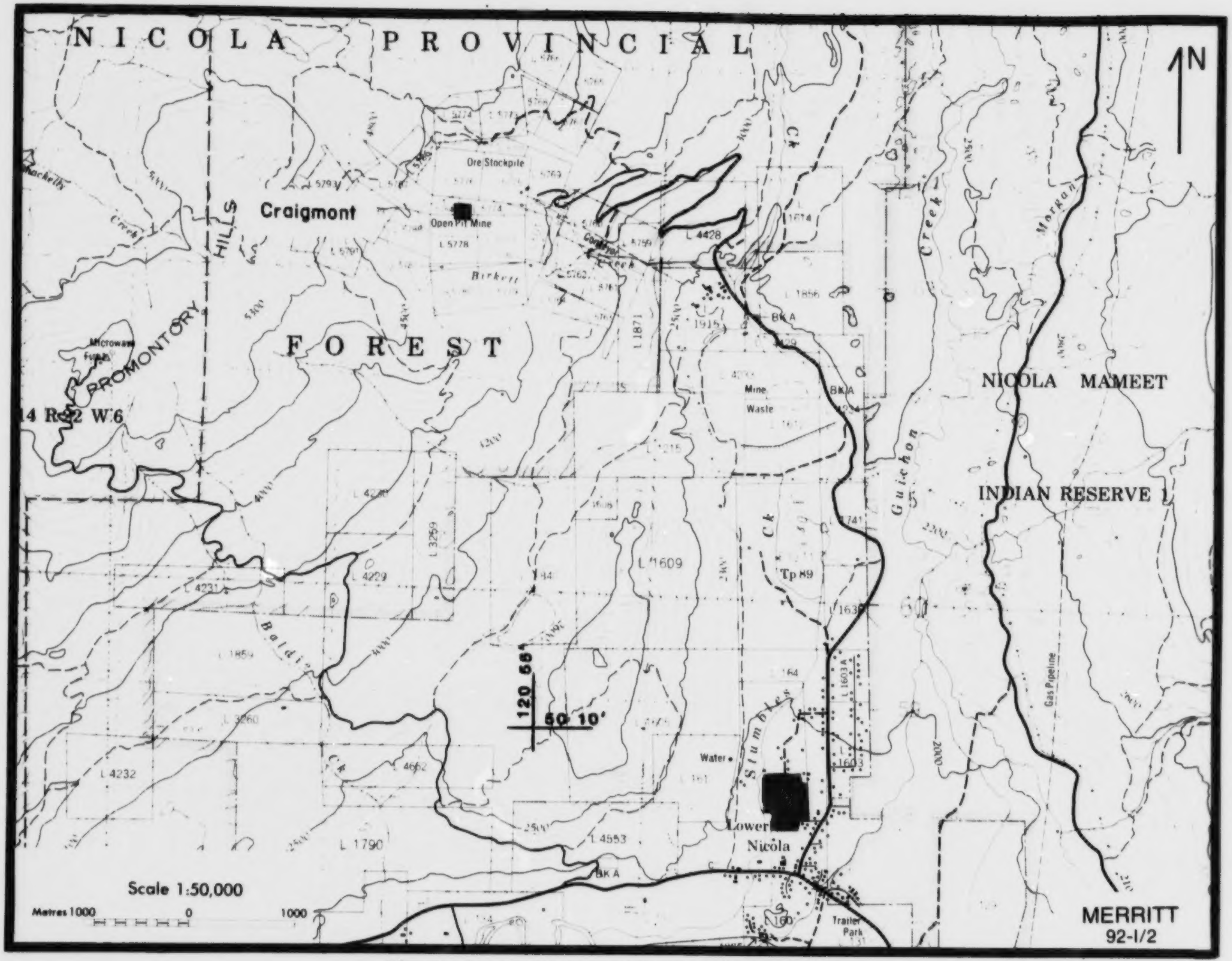

NICOLA PROVINCIAL FOREST
Craigmont
Open Pit Mine
Ore Stockpile
Birkett
Conveyor Creek
PROMONTORY HILLS
Microwave Tower
Creek
14 Rge 2 W6
Mine Waste
Ck
Guichon Creek
Morgan
NICOLA MAMEET INDIAN RESERVE 1
Gas Pipeline
Baldie Ck
Slumbles Ck
Water
Lower Nicola
Trailer Park
Tp 89
120 55'
50 10'
N
Scale 1:50,000
Metres 1000 0 1000
MERRITT
92-I/2

Figure 1 : Location of the Craigmont mine

PRESENT PRODUCER OF MAGNETITE

CRAIGMONT MINE S1 MINFIL: 92I SE 035
TYPE: Skarn NTS: 92I 02
Present Producer LAT: 50 12' LONG: 120 54'
Figure: 1 , 2

The Craigmont mine, situated 12 kilometres northwest of Merritt, is the sole magnetite supplier to the coal industry in the province. Production from the mine commenced in 1961, after a brief exploration period which began in 1956. The mine initially produced copper concentrate from its copper - iron skarn orebody and magnetite was discarded with the mine tailings. It was not until the midpoint of the mine's production history that it began producing magnetite as a commodity. Active mining of the property has now ceased; magnetite is currently produced from a large stockpile which is being steadily reduced by about 50,000 tonnes per annum. As this source is depleted, alternate local sources of magnetite will be required in the near future for the coal beneficiation plants in British Columbia and Alberta.

The Craigmont deposit is adjacent to the southern edge of the Guichon batholith. Host rocks are south facing, steeply dipping, northeast striking strata of the Nicola Group . These rocks are upturned due to the emplacement of the batholith and locally a foliation, parallel to sub-parallel with bedding, has been developed. More calcareous rocks in the sequence show flow features due to strain. Entrained brecciated fragments are often found along the contacts with more competent rocks. Jointing, fracturing and faulting are ubiquitous throughout the deposit. Displacements along faults are small and most of the faulting predates the mineralization. Significant throughout the deposit are a multitude of steeply plunging, "Z" - drag folds that indicate dextral movement. The movement appears to be pre-ore but its origins are unknown (Carr, 1968). Drag folds are best developed within calcareous layers but are not restricted to them. Folds vary in size usually from one to two feet across (30 - 60 cm.), but some are much larger and appear to have some control on ore mineralization.

The Guichon batholith is a quartz - diorite to diorite in the vicinity of the mine. The batholith is interpreted to be the source of the copper - iron skarn mineralization of the Craigmont ore body (Carr, 1968). Several other intrusions are found in or near the ore zone but do not appear to be associated with mineralization. The most prominent of these is a 100 foot (31 m.) wide, vertical andesite dyke which transects the ore body along its length.

The host Nicola Group rocks are of several different lithologies. The ore horizon is primarily confined to calcareous strata and impure limestones, and include limy tuffs, greywackes, and argillites. Clean limestones tend to be unmineralized. Individual beds range from a few feet (1 m.) to 50 feet (15 m.) thick and the whole succession is 600 to 1,400 feet (180 - 420 m.) thick. Bounding and locally interbedded with the limy rock are a sequence of intermediate tuffs, tuff breccias, volcanic conglomerates, tuffaceous greywackes, and argillites. These rocks are generally not of ore grade mineralization but all are altered to some degree.

Several phases of alteration have been identified throughout the deposit. The first phase is potassic alteration near the margins of the batholith. Biotite and orthoclase which replaces plagioclase grains are pervasive in all the rock types. More distant from the batholith rocks are hornfelsed. Hornfelsing is most prominent in the argillites and greywackes near the intrusion where bedding features have been obliterated. The third phase of alteration is the skarning of the calcareous sequence immediately

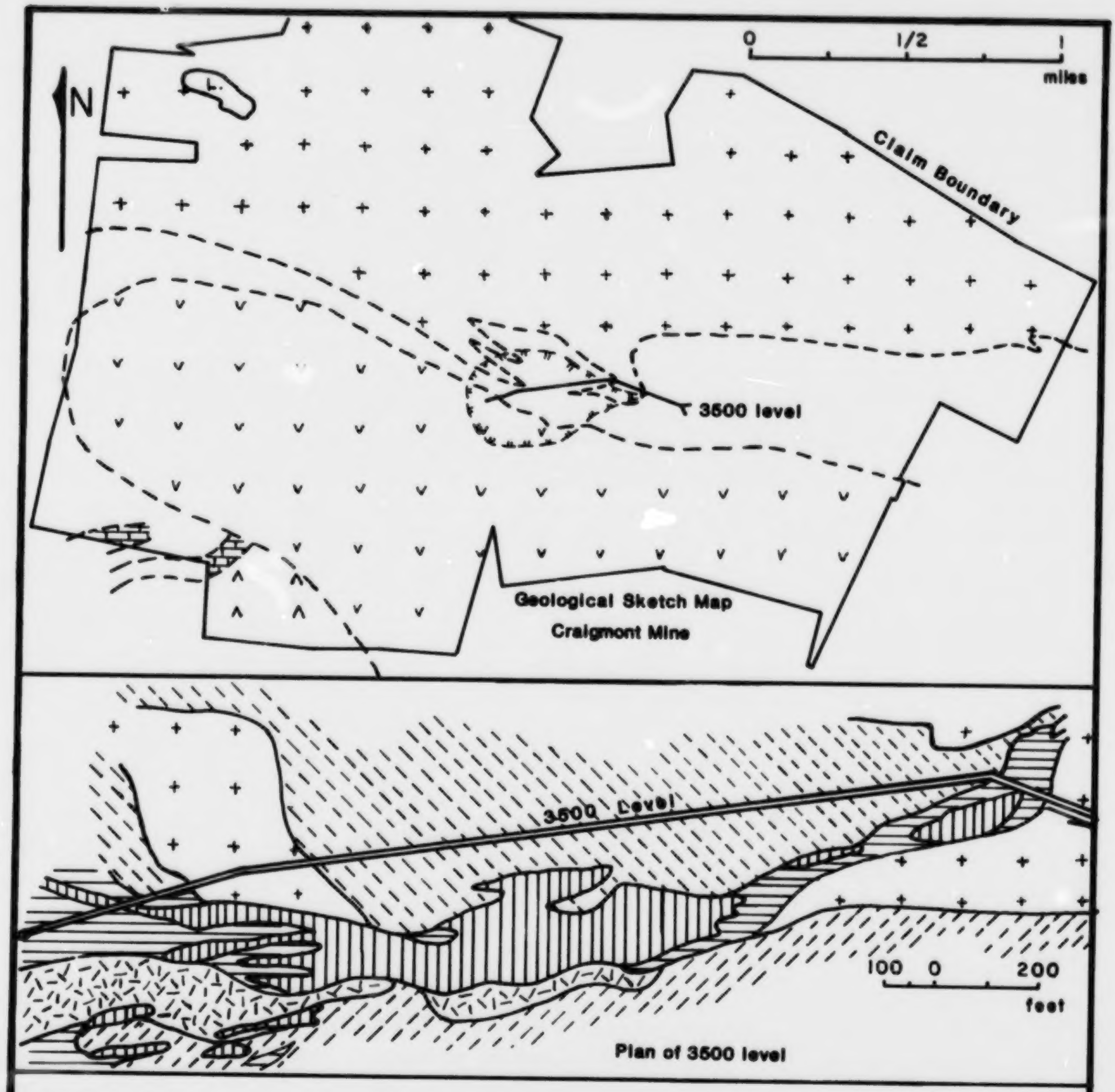

N
0
1/2
1
miles
Claim Boundary
3500 level
Geological Sketch Map
Craigmont Mine
3500 Level
100
0
200
feet
Plan of 3500 level
Kingsvale Volcanic Rocks
Andesite
Guichon Batholith (diorite and granodiorite)
Orebody (Cu)
Ore Zone
Nicola Gp. Feldspathic Rocks
Nicola Gp.Limy Rocks
Nicola Gp. Undifferentiated Rocks
Altered north wall rocks
Altered south wall rocks

Figure 2 : Sketch geology of the Craigmont mine

adjacent to the batholith and results locally in total replacement of the limy rock by garnet, epidote, and amphibole skarn with lesser amounts of chlorite, tourmaline, sericite, and zeolites. The skarn overprints the potassic alteration so biotite and orthoclase are also found in the skarn. Pure limestones are generally altered to marble with little introduction of other minerals. A series of skarn zones extends for nearly 4000 feet (1200 m.) along strike, is more than 2000 feet (600 m.) deep and is 600 feet (180 m.) wide (MMAR, 1961; Company Brochure, 1974). The ore is completely contained within the skarn horizon.

Mineralization consists of magnetite, hematite, chalcopyrite, and minor pyrite. It occurs as pods, lenses and fairly continuous zones of disseminations within the calc - silicate assemblage. Chalcopyrite is associated with, but postdates, the magnetite and is commonly completely enclosed within it. The ore horizon contains three major bodies, the "Main zone", the "Syncline zone", and the "North Limb zone". The "Main" zone is the largest of the three measuring 2,200 feet (660 m.) in length, 200 feet (66 m.) in width, and in excess of 1,200 feet (360 m.) in depth. Its shape is that of an irregular, upright tablet which trends northeasterly. The "Syncline" zone is a keel shaped body, just northwest of the "Main" zone, in the lower reaches of the mine and the "North Limb" zone is a small, fold controlled, arch shaped projection off the lower north side of the "Main" zone. (MMAR, 1961, pp.35 plus cross-section) Initial ore reserves totalled 22,241,000 tons (20.2 million tonnes) grading 2.09 percent copper and 19.8 percent iron (magnetite and hematite) (MMAR, 1960, pp. 40).

Total production for the mine was 1,455,076 tons (1.3 million tonnes) of copper concentrate from approximately 35 million tons (31.7 million tonnes) of ore. (Company Brochure, 1974; MMAR, 1975 - 80; Canadian Mines Handbook, 1981 - 83). Later production averaged 1.34 percent copper and 18.5 percent iron. The deposit as a whole averaged 14 percent magnetite and 12 percent hematite (Company Brochure, 1974; Letter to the Minister of Mines, 1963). As well as shipping copper, the mine began shipping magnetite concentrate to a B.C. coal mine for heavy media separation in 1970. Initially, stockpiled mill tailings were processed for their magnetite content and later the raw ore was processed for magnetite. Initial shipments were about 20,000 tons (18,000 tonnes) per annum then increased to almost 50,000 tons (45,000 tonnes) per annum in 1986 (MMAR 1970 - 72; Kilborn Engineering, 1986). A total of 470,560 tons (426,882 tonnes) of magnetite concentrate were shipped up to the time that the mine closed. (MMAR, 1970 - 1980; Northern Miner, 1982, Dec. 30). Since 1983, concentrates have been shipped from an initial stock pile of 600,000 tons (544,308 tonnes) at a rate of 40,000 to 50,000 tons (36,000 - 45,000 tonnes) per annum (Northern Miner, 1982, Dec. 30).

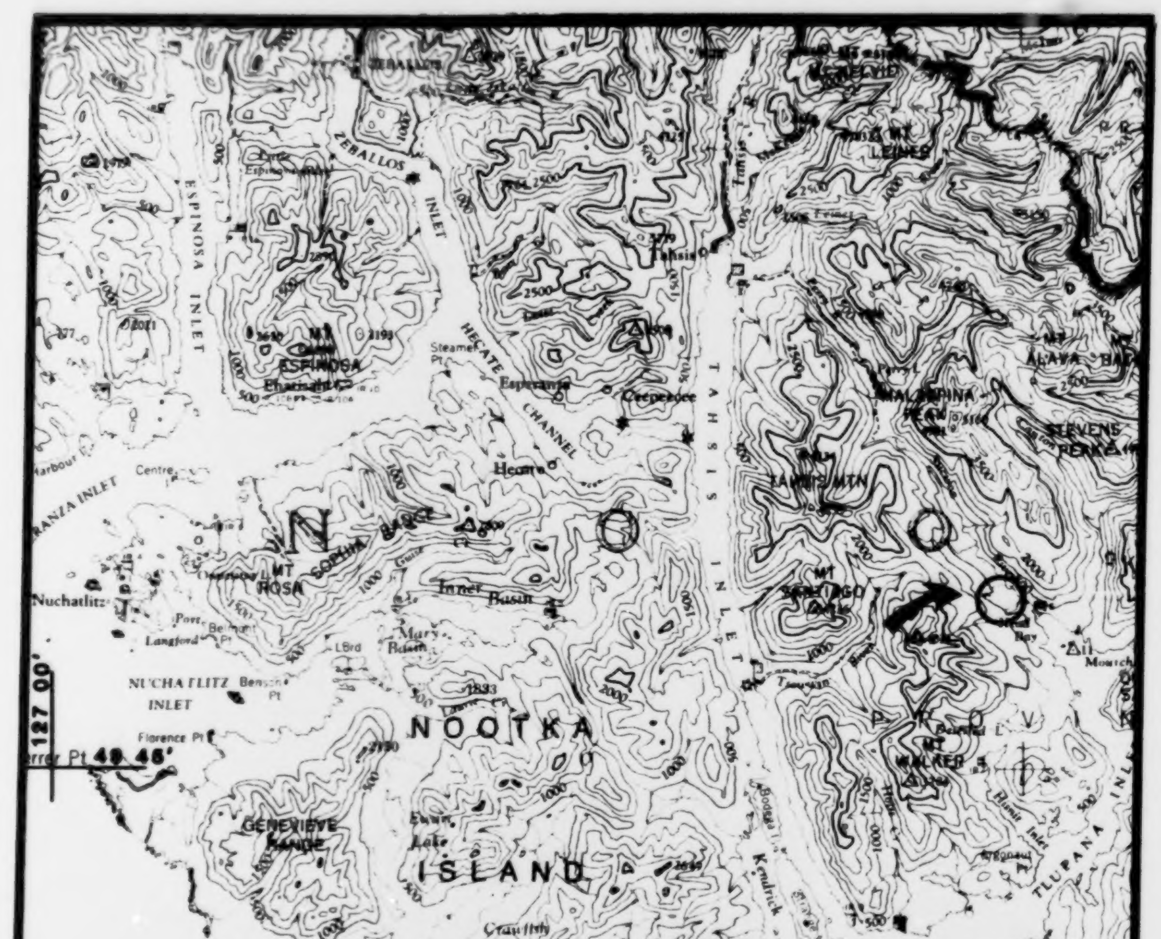

GLENGARRY, STORMONT
NOOTKA ISLAND
NOOTKA SOUND
SHEET 92 E
ESPINOSA INLET
ZEBALLOS INLET
HECATE CHANNEL
TAHSIS INLET
Kendrick Inlet
COOK CHANNEL
TLUPANA INLET
MT ESPINOSA
MT ROSA
SOPHIA RANGE
GENEVIEVE RANGE
SANTA CRUZ DE NUCA MTN
TAHSIS MTN
MT SANTIAGO
MT WALKER
MALASPINA PEAK
STEVENS PEAK
MT ALAVA
MT LEINER
MT McKELVIE
MT BAUKE
MT SERJEANT
Tahsis
Esperanza
Ceepeecee
Nuchatlitz
Nuchatlitz Inlet
Inner Basin
Mary Basin
Bajo Point
Yuquot
Nootka
Boston Pt
Salter Pt
Descubierta Pt
Concepcion Pt
Burdwood Pt
Escalante Pt
Maquinna Pt
Yuquot Pt
Spanish Pilot Group
Bligh Island
Florence Pt
Benson Pt
Steamer Pt
Hecate
Crawfish Lake
Ewart Lake
127 00'
49 48'
N
Kilometres
NOOTKA

Figure 3 : Location of the Glengarry and Stormont Crown Grants

Vancouver Island

GLENGARRY, STORMONT	S2	MINFIL:	92E 001
TYPE: Skarn		NTS:	92E 016
Past Producer		LAT: 49 48'	LONG: 126 31'
Figure: 3, 4			

The Glengarry and Stormont claims are located at the head of Head Bay in Nootka Sound. Mineralization consists of magnetite in a garnet skarn. The property is of significant interest because only a portion of the available reserves were mined before the operating company went into receivership.

Host rocks of the deposit are limestones of the Quatsino Formation. They strike northwest and dip about 45 degrees to the southwest (Young and Uglow, 1926). Limestone strata have been recrystallized or altered to garnetite. Intruding the limestones to the east and south is a large granodiorite body and associated with it are many diorite dykes which cross - cut the limestone. Intrusion of the dykes predates the skarn event and so may represent an early phase of intrusion associated with the granodiorite (ibid.).

Mineralization is contained within a garnet skarn. Magnetite is often, but not always, free of garnet. The deposit is composed of eleven major pods of magnetite which outcrop 7 to 40 feet (2 - 12 m.) across. The pods are parallel to bedding and roughly follow the margin of the intrusive in a northwesterly direction. The total exposure of magnetite outcrops covers an area 1860 feet by 1320 feet (567 by 403 metres) (ibid.). Sulphides are rare within the deposit, with a small amount of pyrite being found in some of the eastern pods. Chalcopyrite is present only in small quantities. An assay of magnetite gave the following values: Iron = 56.8 percent, Sulfur = 0.1 percent, Phosphorous = trace, Silica = 1.6 percent (MMAR, 1916, pp. K243).

The properties were staked in 1902 by Mssrs. Stockham, Grant and Dawley. Development consisted of surface stripping and prospecting. In 1916, Canadian Collieries (Dunsmuir) Ltd. optioned the properties for further exploration and they later purchaced the properties. In 1951 they were optioned by Japanese interests and a small drilling program was undertaken over the next two years. Data from 115 short holes totalling 6,972 feet (2,126 m.) indicated 360,000 tons (326,584 tonnes) of magnetite ore with an average of 42.7 percent iron (MMAR, 1956, pp. 133). In 1959, a small open pit mining and milling operation was set up by Haulpai Enterprises Ltd of Japan. 125,715 tons (114,046 tonnes) of ore and waste were mined, from which 62,500 tons (56,698 tonnes) were milled. This produced 25,000 tons (22,680 tonnes) of magnetite concentrate (MMAR, 1959, pp. 135). In January of 1960, Hualpai Enterprises Ltd. went into receivership and the mine was closed. There has been no further work done on the properties.

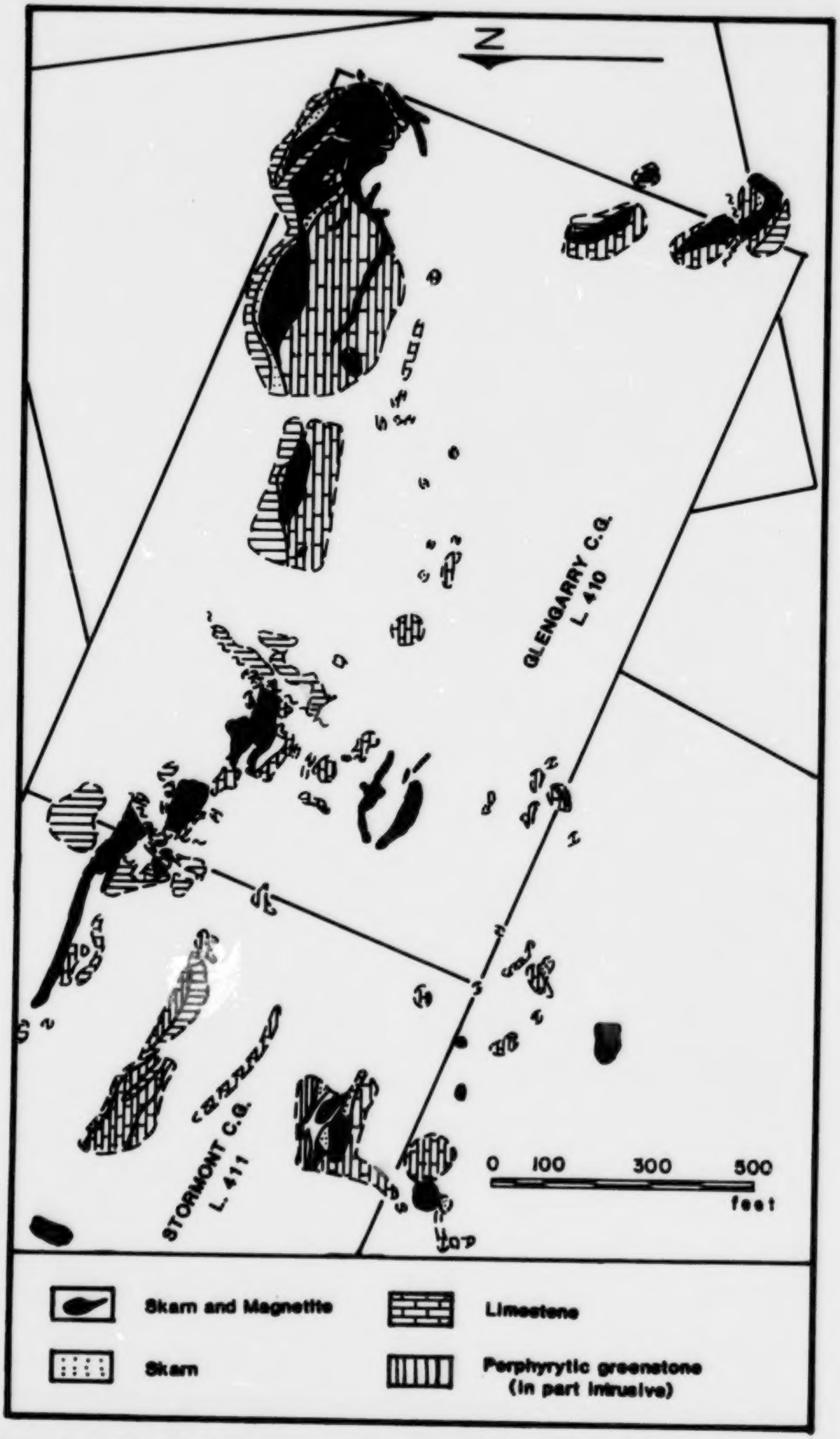

N
GLENGARRY C.G.
L. 410
STORMONT C.G.
L. 411
0 100 300 500
feet
Skarn and Magnetite
Limestone
Skarn
Porphyritic greenstone
(in part intrusive)

Figure 4 : Sketch geology of the Glengarry and Stormont Crown Grants (after EMPR Annual Report, 1959 and Canadian Collieries (Dunsmuir) Ltd.)

KENNEDY LAKE, BRYNNOR S3 MINFIL: 92F 001
TYPE: Skarn NTS: 92F 03
Past Producer LAT: 49 03' LONG: 125 26'
Figure: 5, 6

The Kennedy Lake mine occurs within a sequence of limestones and tuffs that are cut off to the south by a large quartz diorite stock and intruded by syenite porphyry and diorite dykes. Tuffs show partial alteration to sericite, epidote, chlorite, and serpentine in thin - section and limestones are commonly only recrystallized.The skarn mineralization is predominantly garnet - epidote alteration of the tuffs. It envelopes the pods of magnetite for thicknesses up to a few tens of feet. Skarn does not appear disseminated within the magnetite or the surrounding limestone and tuff beyond the alteration envelope. However, many dioritic dykes are partially or completely altered to skarn. The host rocks have been folded into a broad anticline which plunges at a low angle to the southwest and cut by a number of small faults. These structures generally precede the mineralizing events.

The magnetite is quite clean, containing only trace amounts of calcite, pyrite, and pyrrhotite. It appears to be late stage mineralization due to its purity and some cross-cutting relationships. Mineralized pods are found to be constrained to the contact between the limestone and tuff. Small, isolated pods of mineralization also are found scattered within the tuffs, but are of no economic consequence. Magnetite and skarn are preferentially located where dykes cross the limestone - tuff contact. No magnetite is found within the dykes, however.

First reports of magnetite in the area were in 1902. Dip needle surveys performed on Draw Creek (then Magnetic Creek) located a significant, pinpoint magnetic anomally. In 1960, Mr. E. Chase staked 25 claims over the magnetic anomally on Draw Creek between Maggie and Kennedy lakes. In May of the same year, Kennedy Lake Iron, a wholly owned subsidiary of Noranda Mines Limited, purchased eight claims and optioned the 25 claims. Noranda Mines Ltd. promptly began a large drill program on the property by years end and completed 22,542 feet (6,875 m.) of drilling. The prepatory work for mining was completed by May of 1962. The pit was centered over two of the largest magnetite pods. The two main pods were cigar shaped with the larger 300 feet (92 m.) in length and the smaller being 150 feet (46 m.) in length. Mining was by open pit methods and the mill began test production in April of 1962 with full production soon following. Mining ceased at the end of 1967, but milling of stockpiled ore continued through the majority of the following year. The total production of the mine for the period 1962 to 1968 was 4,308,959 tons (3.9 megatonnes) milled with 3,273,278 (2.7 megatonnes) tons of magnetite concentrate shipped (MMAR, 1968, pp. 103). In 1969, 41,823 tons (37,940 tonnes) of ore were milled with an unspecified tonnage of concentrate shipped (MMAR, 1969, pp. 426).

During the period of open pit mining, extensive underground development was done. In 1962, a three compartment shaft was sunk a total of 1,234 feet (376 m.) below surface. Three major cross-cuts were driven at the 400, 600, and 750 foot (122 m., 183 m., 229 m.) levels and several other, smaller cuts were driven at other levels. Approximately 6,450 feet (1,967 m.) of drifting and cross-cutting and 1,002 feet (306 m.) of raising were done. In 1967, all underground workings were abandoned and allowed to flood. There are still reserves present at the mine, but reserve figures were not made public. Remaining magnetite mineralization becomes more massive and continuous with depth as does skarn mineralization.

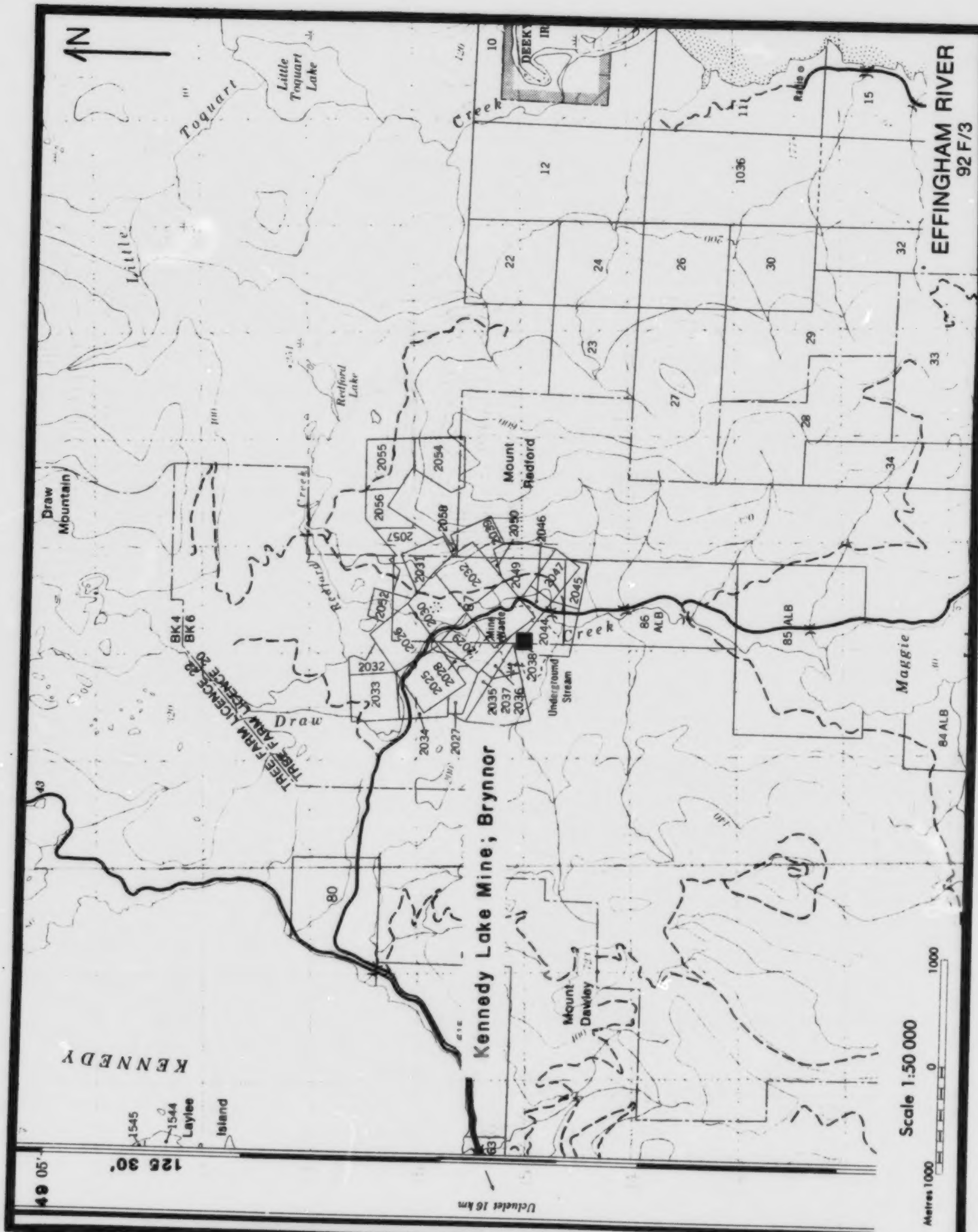

N
Little Toquart Lake
Toquart
Little
Creek
DEEKY
10
12
11
1036
Radio
15
22
24
26
30
32
23
27
29
28
33
34
EFFINGHAM RIVER
92 F/3
Redford Lake
Draw Mountain
Mount Redford
Redford
Creek
2055
2054
2056
2057
2058
2059
2050
2046
2031
2032
2049
2047
2045
2052
2030
2026
2029
2048
2044
2032
2033
2025
2028
2027
2034
2035
2037
2036
2038
Mine Waste
Underground Stream
Creek
86 ALB
85 ALB
84 ALB
Maggie
BK4
BK6
TREE FARM LICENCE 20
TREE FARM LICENCE 22
Draw
43
80
Kennedy Lake Mine; Brynnor
Mount Dawley
KENNEDY
1545
1544
Laylee
Island
63
49 05'
125 30'
Ucluelet 16 km
Scale 1:50 000
Metres 1000
0
1000

Figure 5 : Location of the Brynnor mine

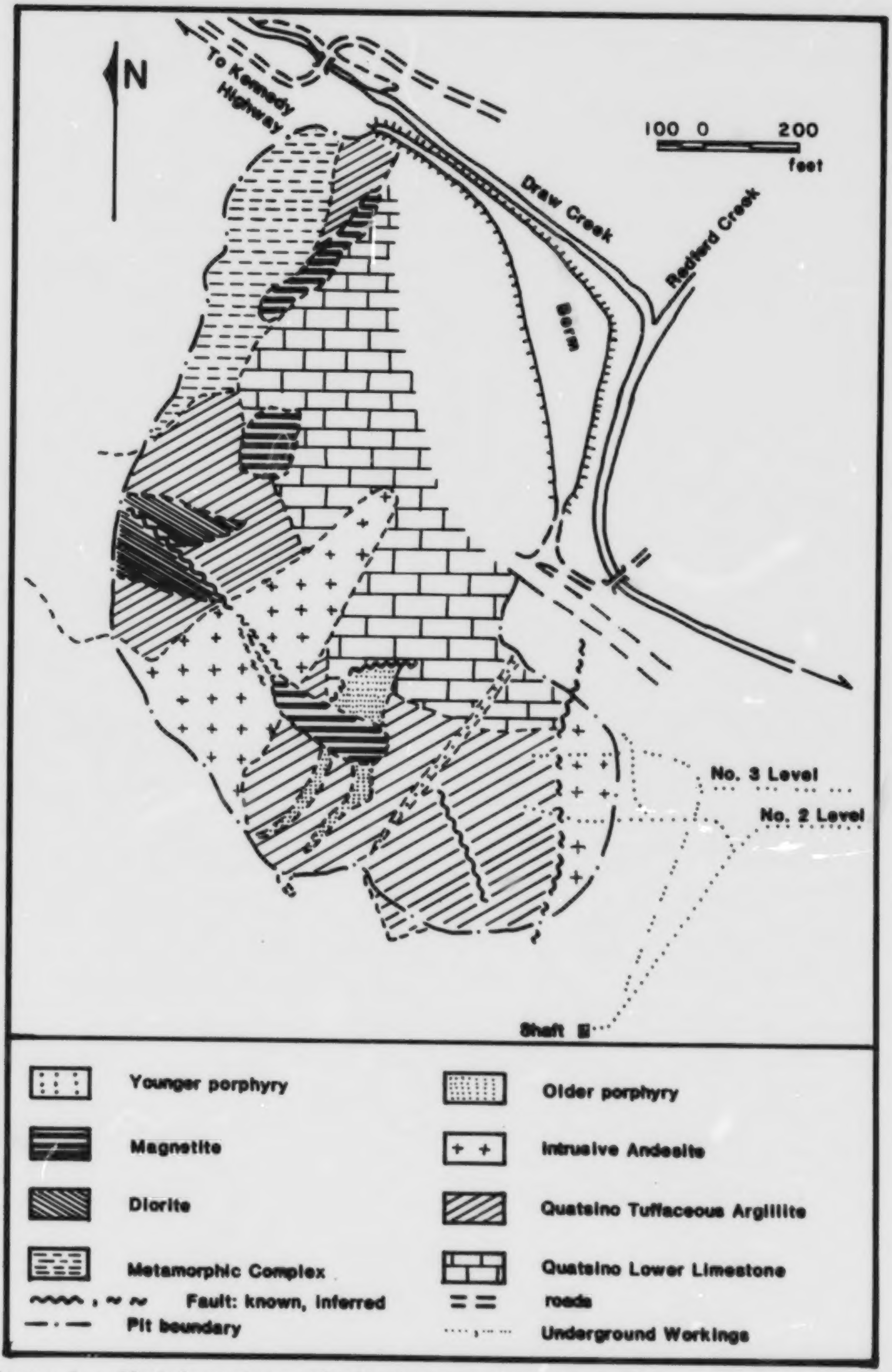

N
To Kennedy Highway
100 0 200
feet
Draw Creek
Redford Creek
Berm
No. 3 Level
No. 2 Level
Shaft
Younger porphyry
Older porphyry
Magnetite
Intrusive Andesite
Diorite
Quatsino Tuffaceous Argillite
Metamorphic Complex
Quatsino Lower Limestone
Fault: known, inferred
roads
Pit boundary
Underground Workings

Figure 6 : Sketch geology of the Brynnor deposit (after Eastwood, 1968)

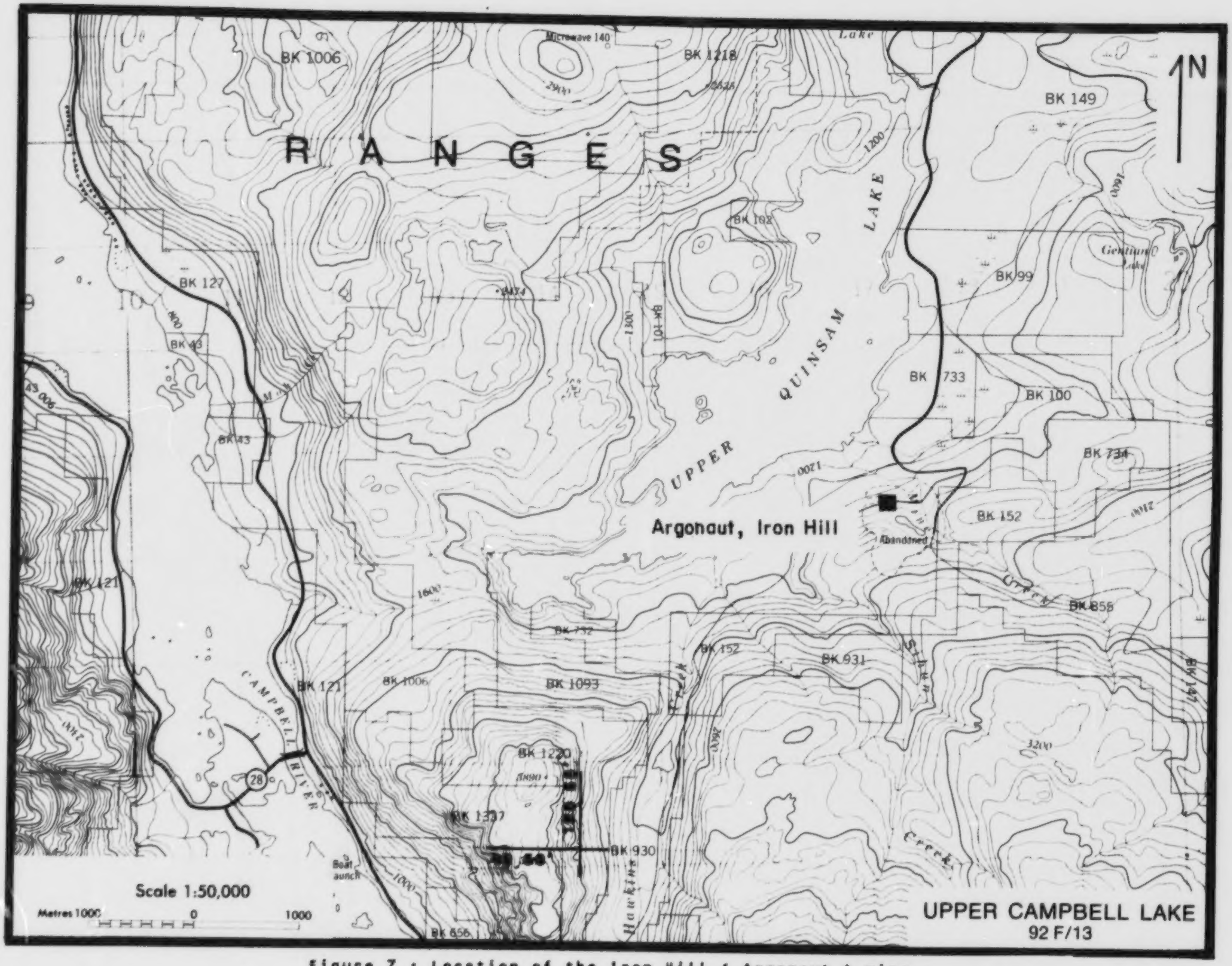

N
RANGES
UPPER QUINSAM LAKE
Argonaut, Iron Hill
Abandoned
Microwave 140
Gentian Lake
CAMPBELL RIVER
Creek
Hawkins
Boat Launch
28
BK 1006
BK 1218
BK 149
BK 102
BK 127
BK 43
BK 101
BK 99
BK 733
BK 100
BK 734
BK 152
BK 855
BK 121
BK 732
BK 931
BK 1093
BK 147
BK 1220
BK 1337
BK 930
BK 656
Scale 1:50,000
Metres 1000
0
1000
UPPER CAMPBELL LAKE
92 F/13

Figure 7 : Location of the Iron Hill (Argonaut) mine

Iron Hill, Argonaut Mine S4
TYPE: Skarn
Past Producer
Figure: 7, 8

MINFIL: 92F 075
NTS: 92F 13
LAT: 49 51' LONG: 125 33'

The Argonaut Mine is a massive magnetite - magnetite/garnetite skarn situated on Iron Hill, just east of upper Quinsam lake. The skarn is near the contact of Quatsino limestone and an overlying basic volcanic unit of the Upper Triassic Vancouver Group. Beneath and intruding Vancouver Group rocks is a granodiorite stock of the Jurassic Quinsam intrusions. Although the limestone is completely recrystallized, there has been no alteration and the original bedding has been preserved. The basic volcanic package is a sequence of pillow basalts which have been weakly metamorphosed. Locally the basalts have been hornfelsed near the contact with the granodiorite.

The deposit has been deformed into an overturned syncline whose axial plane strikes generally east - west and dips north - northwest. It should be noted that the axial plane is irregularily curved along strike. Skarn is best developed and thickest in the hinge portion of the syncline.

Skarn mineralization occurs along the contact between limestone and the pillowed basalts and consists of massive garnet and magnetite with minor amounts of epidote, calcite, and pyrite. The margin of the skarn and host rocks is sharp and irregular. Skarn mineralization rarely occurs outside of the main body and then only as small irregular pods. The skarn mineral assemblage varies from pure, coarsely crystalline massive magnetite at its core to a mixed, crystalline magnetite/garnetite near the margin and a boundary phase of pure crystalline garnetite. In the main body of the skarn, bedding replacement features are present indicating that hydrothermal fluid migration took place preferentially along bedding planes of the limestone. Skarn has preferrentially replaced the limestone with respect to the basalts.

The Iron Hill property was originally staked in 1901 but it was not until 1948 that the Coast Iron Company began quarrying the high grade, direct shipping magnetite ore. Approximately 1,000 tons (907 tonnes) of ore were shipped that year to an American smelter in Wenatchee, Wash. (MMAR, 1948, pp. A158). The Coast Iron Company continued operations through 1949, shipping a total of 4,885.9 long tons (4,964 tonnes) of ore (MMAR, 1949, pp. A226). By October of 1949, the Argonaut Company Ltd. optioned the property and began an extensive diamond drilling program.

The Argonaut Co. Ltd. greatly enlarged the previous quarry operation, installed a mill and concentrator, and improved the road access. In September 1951, the company's first shipment of 9,435 long tons (9,586 tonnes) of ore was made. Total production for the year was 102,526 long tons (104,171 tonnes) (MMAR, 1951, pp. A198 - A199). The mine operated continuously through to 1956 when the economic limit of mining was reached. Salvage processing and cleanup, including reworking the tailings, was performed for the balance of 1956 and continued for fpur months in mid - 1957. The mine was closed and all equipment removed in the summer of 1957. Mining grades during the peak of operations were: head grade = 38.4 percent ; concentrate grade = 56 percent ; tailings grade = 17 percent total iron (MMAR, 1955, pp. 79).

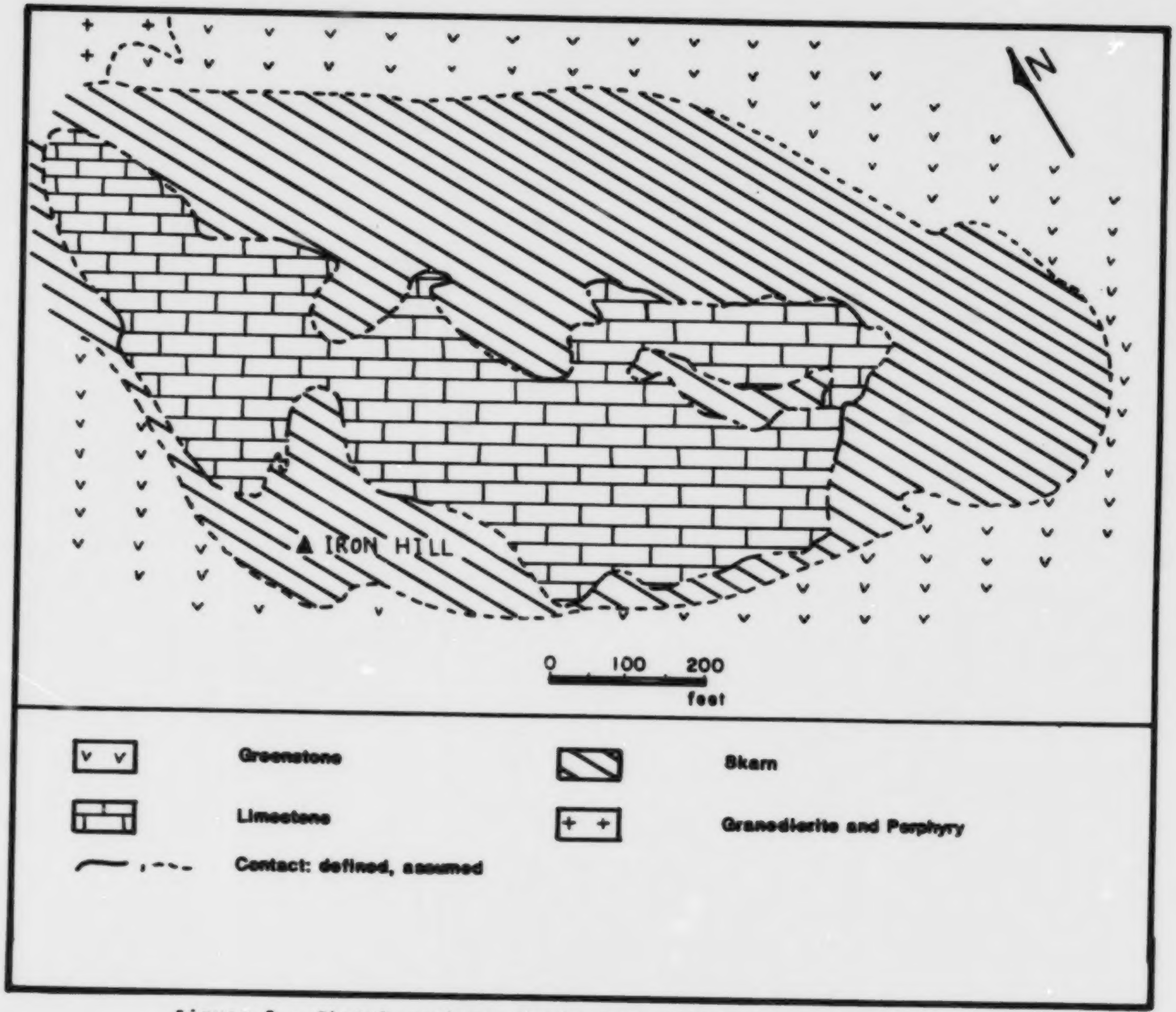

N
IRON HILL
0 100 200
feet
Greenstone
Skarn
Limestone
Granodiorite and Porphyry
Contact: defined, assumed

Figure 8 : Sketch geology of the Iron Hill (Argonaut) deposit
(after EMPR Annual Report, 1952)

IRON MIKE S5 MINFIL: 92K 043
TYPE: Skarn NTS: 92K 05
Past Producer LAT: 50 17' LONG: 125 56'
Figure: 9, 10

The Iron Mike claim group lies about six kilometres south of Sayward, Vancouver Island. The deposit is a garnet - epidote - magnetite skarn which occurs along the contact between an underlying greenstone and an overlying limestone. The units are not specifically defined, but are probably basalts of the Karmutsen Group and limestone of the overlying Quatsino Formation. Within the zone of skarning the volcanics are brecciated and the limestone is replaced by skarn. The mineralized zone appears to occur along the crest of a small anticline or arch that strikes and plunges gently southeast. There appears to be no significant faulting on the property.

Mineralization is magnetite, essentially free of any impurities, within the skarn. During production, mill feed grades averaged 45 percent iron with no contained impurities. The ore body was originally 1000 feet by 200 feet by 34 feet (avg.) (907 m. by 181 m. by 31 m.) of pure magnetite (Hill and Starck, 1964, a & b). Chalcopyrite and pyrite are reported to occur but their abundance and location are not specified. In 1965, drilling delineated reserves of 758,700 tons (688,277 tonnes) proven ore and 294,300 tons (266,983 tonnes) probable ore, both grading 43.5 percent iron (Hill and Starck, 1965). Production by Orecan Mines Ltd. began in 1965 and continued through to September of 1966. 186,000 tons (168,735 tonnes) of ore were mined and 91,341 tons (82,862 tonnes) of 62.25 percent iron concentrate were shipped (MMAR, 1966, pp. 69). The mine was closed in 1966 for financial reasons. The property remained idle until 1969. In that year, 33,000 tons (29,937 tonnes) of stockpiled concentrate were shipped (BCMEMPR, Min. Res. Div., Corporate Files). Since then the property has remained idle.

F.L. , FORD S6 MINFIL: 92L 028
TYPE: Skarn NTS: 92L 02
Past Producer LAT: 50 01' LONG: 126 49'
Figure: 11, 12

The F.L. mine is a large massive magnetite skarn deposit located on the Zeballos River on Vancouver Island. It is situated in a limestone - tuff roof pendant bounded on three sides by the Zeballos batholith. The limestone is an upper portion of the Quatsino Limestone and is overlain by tuffs of the Bonanza Group. The limestones are extensively recrystallized, with bedding features generally obscured. The tuffs are massive and coarsely crystalline and are also extensively recrystallized. In many places there are intrusions of diorite dykes into the tuffs. Often the differences between the dykes and tuffs are unclear. It is believed that the diorite dykes are intrusive phases of the Bonanza volcanic pods. The amount of dyking within the tuffs is greatest at the southwest end of the deposit and drops off significantly to the northeast. The Zeballos batholith is in contact only with the tuffs and the contacts are gradational.

The roof pendant is a recumbent to overturned anticline that plunges southwest and opens to the southeast, exposing the limestone. Beds dip moderately to the northwest at surface, but at increasing depth the dips are near vertical and are projected to overturn below the drilled depth. Two major faults occur within the deposit. The more significant one is a post - ore fault which cuts the main ore body in half. Movement on the fault is right lateral with about 100 to 200 feet (31 to 61 m.) of offset. The fault strikes northwest and dips nearly vertical. For mine

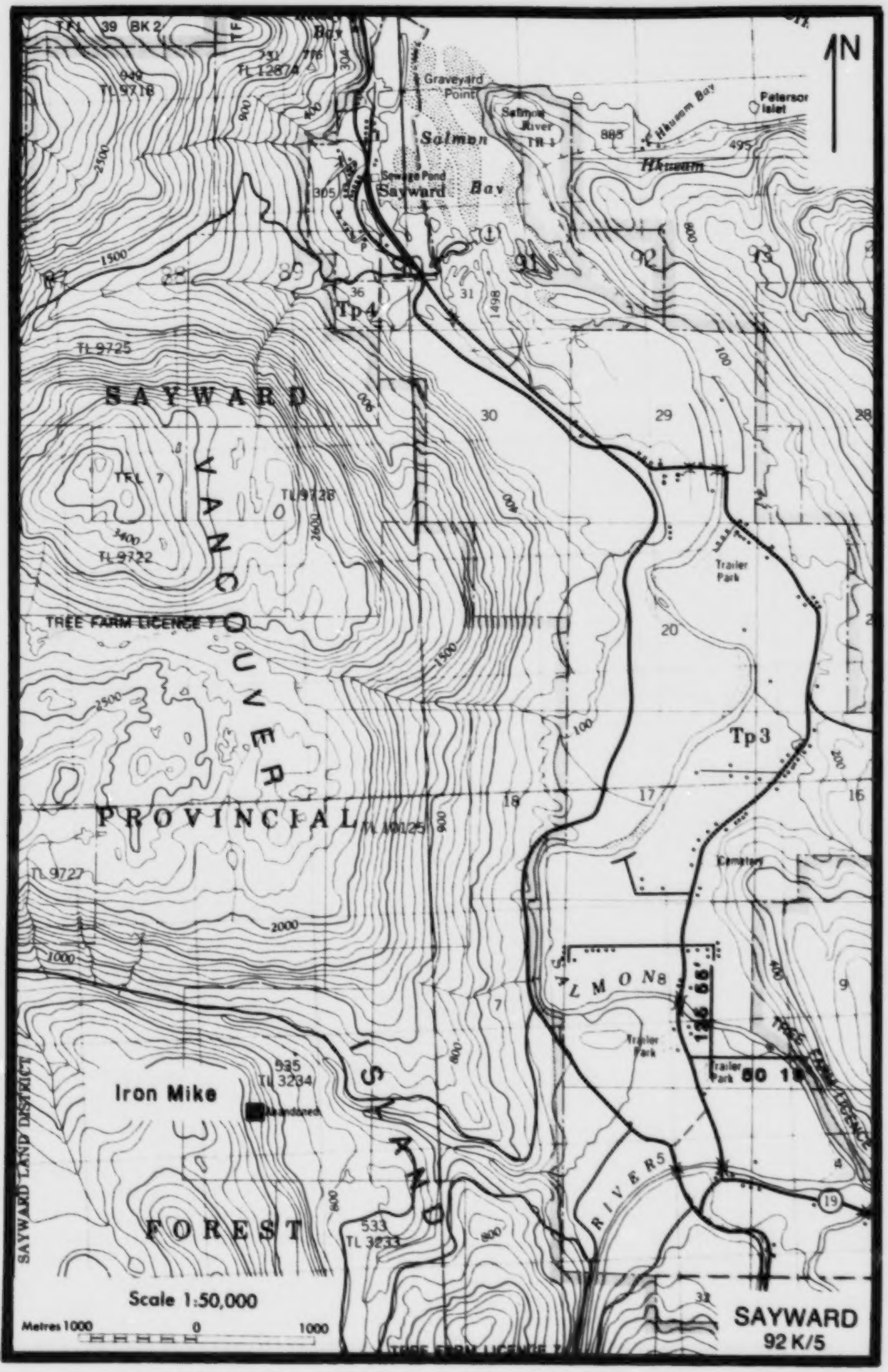

N
Graveyard Point
Salmon River
Salmon
Sayward
Bay
Hkusam Bay
Peterson Islet
Hkusam
Sewage Pond
Tp4
Tp 3
SAYWARD
VANCOUVER
PROVINCIAL
ISLAND
FOREST
TREE FARM LICENCE 7
TFL 7
SALMON
RIVER
Trailer Park
Cemetery
Iron Mike
Abandoned
TL 3234
TL 3233
TL 9725
TL 9722
TL 9728
TL 9727
TL 9718
TL 10125
TL 12874
SAYWARD LAND DISTRICT
Scale 1:50,000
Metres 1000
0
1000
SAYWARD
92 K/5

Figure 9 : Location of the Iron Mike mine

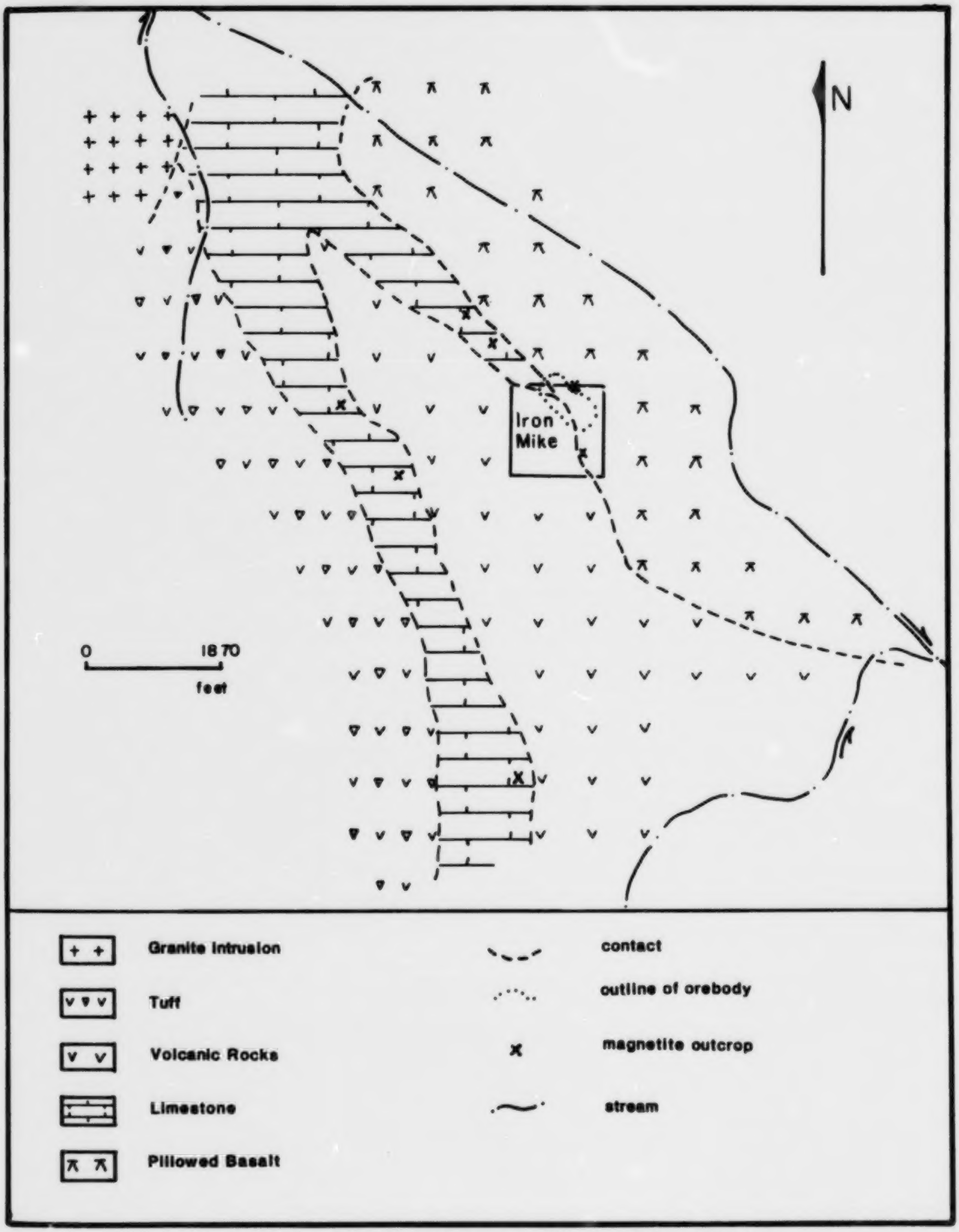
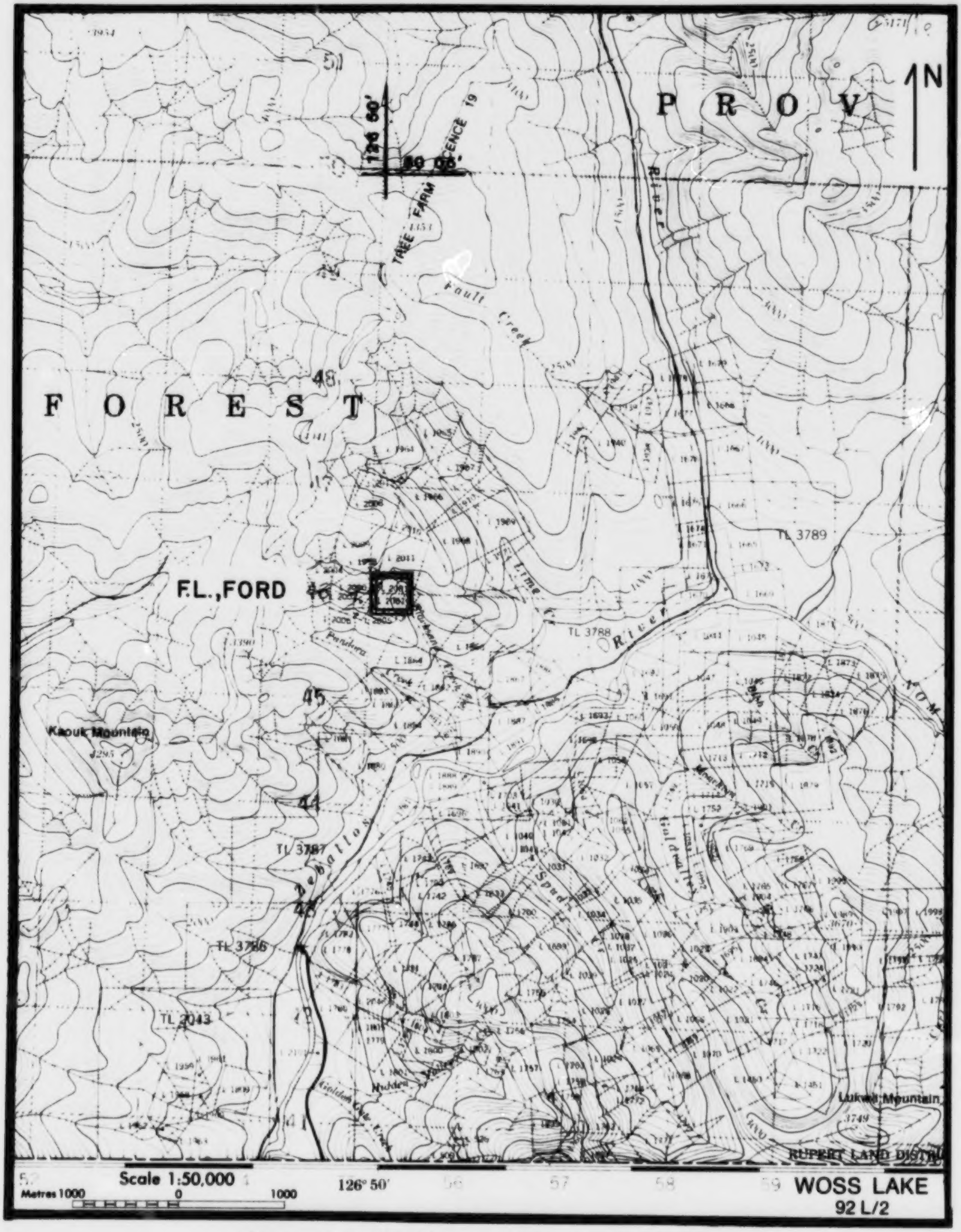

N
Iron Mike
0
1870
feet
+ +
Granite Intrusion
v ▾ v
Tuff
v v
Volcanic Rocks
Limestone
ㅈ ㅈ
Pillowed Basalt
contact
outline of orebody
x
magnetite outcrop
stream

Figure 10 : Sketch geology of the Iron Mike deposit
(after Hill and Starck, 1964 and Orecan Mining Co. Ltd.)



P R O V
N
126° 50'
50° 05'
TREE FARM LICENCE 19
Fault Creek
River
F O R E S T
TL 3789
F.L.,FORD
Lime Cr
TL 3788
River
Pandora Creek
Kaouk Mountain
Zeballos
TL 3787
Spud
TL 3786
TL 2043
Lukwa Mountain
RUPERT LAND DISTRI
Scale 1:50,000
Metres 1000
0
1000
126° 50'
WOSS LAKE
92 L/2

Figure 11 : Location of the F.L., Ford mine

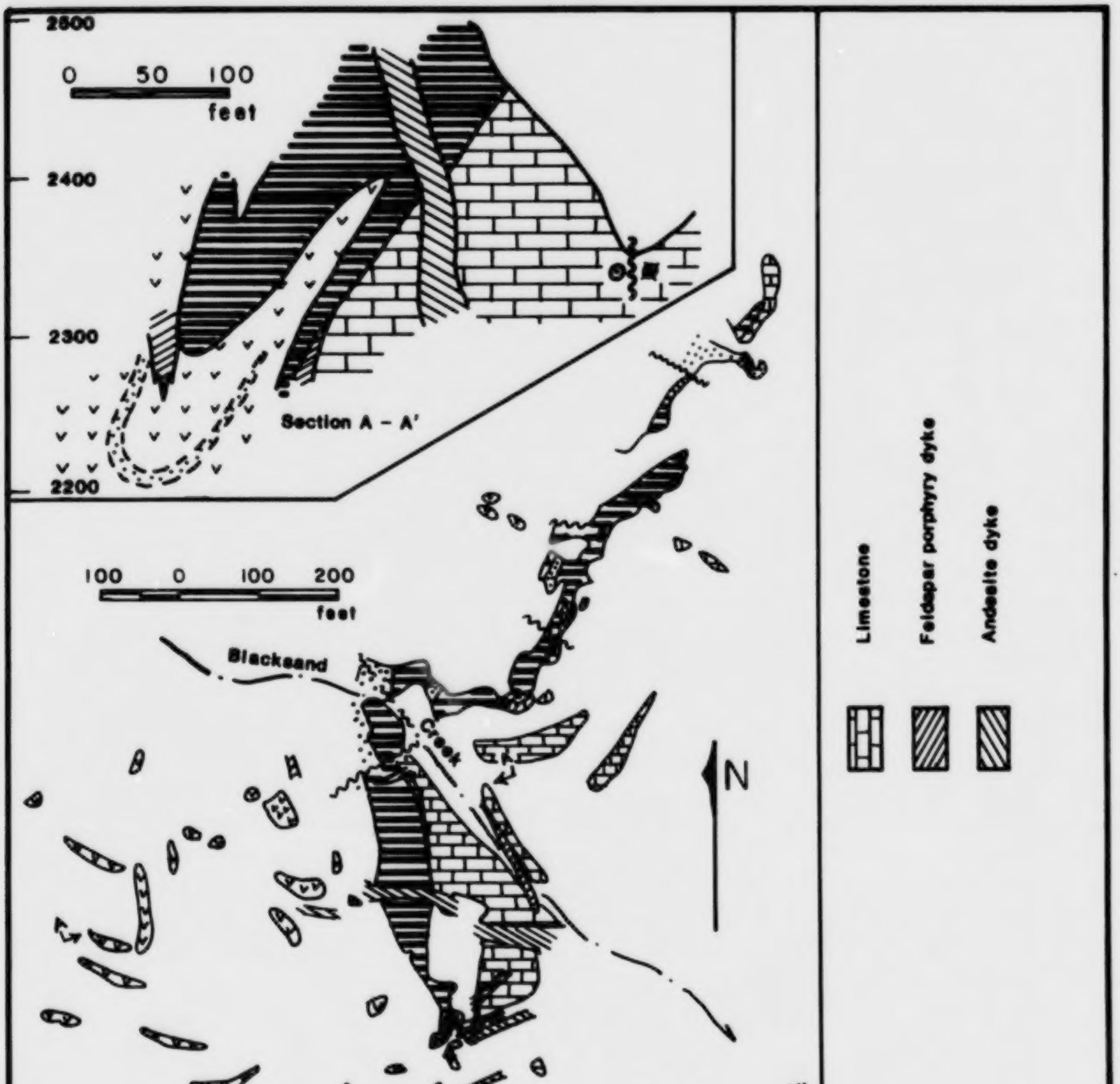

2500
0 50 100
feet
2400
2300
2200
Section A - A'
100 0 100 200
feet
Blacksand
Creek
N
Limestone
Feldspar porphyry dyke
Andesite dyke
Magnetite
Skarn
Greenstone
fault

Figure 12 : Sketch geology of the F.L., Ford deposit (after EMPR Annual Reports, 1952 (plan) and 1960 (section))

purposes, the fault separates the ore body into the southwest "A" zone and the northeast " B " zone. A second fault, nearly parallel to the main fault, transects the "A" zone about 500 feet (153 m.) to the southwest. There appears to be little offset on this post - ore fault.

Mineralization occurs in several discrete segments. The magnetite body is lowest and it is immediately overlain by a layer of skarn. Another layer of skarn occurs about 200 feet (61 m.) above the lower skarn.

The magnetite zone is a tabular unit, 100 feet (31 m.) thick, with a northeast strike and a northwest dip. It pinches out at the northeast end along the tuff - limestone contact and in the southwest portion, fingers out in the tuffs. The magnetite follows the limestone - tuff contact down dip then cross cuts straigraphy straight into the tuffs as the contact curves downwards to become vertical. The bottom margin of the magnetite is sharp against the limestone and is distinct when in contact with the tuffs. In a few locations a thin layer of pyrite occurs between the magnetite and limestone. In places, the top of the magnetite body grades into skarn, but generally it is in sharp contact with the tuffs. At the southwest end of the deposit, the tuffs are intruded by the Zeballos batholith. As the tuffs and limestone wrap around the nose of the anticline to the south, the magnetite continues straight into the batholith. The magnetite fingers out rapidly within a migmatitic zone at the edge of the batholith. The general shape and location of the magnetite body suggests that the tuffs were replaced preferentially by magnetite along a plane of weakness which crosscuts the host formation. (MMAR, 1962, pp. 100 - 103)

The magnetite is essentially free of impurities for most of its extent. It is also chemically quite pure. Assays from samples collected in 1950 assayed, on average, 67.5 to 68.5 percent iron, up to 3.0 percent silica, up to 0.2 percent sulfur, and trace titanium and phosphorous (Stevenson, 1950, pp. 128). The upper limit of the magnetite is in direct contact with tuffs in general but is intermixed with skarn minerals in some places. The magnetite is fine grained, dense, and massive and commonly occurs as octahedral grains varing in size from 1/8 inch to 1/2 inch (3 to 13 mm.) across (ibid.).

The skarn is limited to the Bonanza tuff unit. The replacement minerals are predominantly pyroxene and epidote with only minor garnet and other calc - silicate minerals. This assemblage is different from the more typical skarn garnet - epidote assemblages elsewhere on Vancouver Island (Sangster, 1969). For the most part, the skarn forms an irregular layer 100 feet (31 m.) thick , 10 feet (3 m.) above the magnetite and parallel to it. Skarn is found above and below the magnetite only where the magnetite is within the migmatitic zone of the batholith. Contacts between the tuffs and skarn are gradational and irregular. In the "A" zone, about 200 feet (61 m.) above the first skarn layer there is a second layer of skarn. However, no magnetite appears to be associated with the second skarn layer. Skarn mineralization does not occur in the limestone unit. (MMAR, 1960)

The Ford property is located on a precipitous mountain side facing south onto the Zeballos river. The original discovery of the outcrops was probably in the early 1920's during a small gold rush in the area. However, the claims were not staked until about 1937 - 38, when several other adjoining claims were also staked. The discovery outcrops were the two cliffs, about 1500 feet long, on each side of Black Sand creek. Extensive prospecting and diamond drilling was done by several companies until 1960. In 1959, Zeballos Iron Mines Ltd. optioned or bought all the claims which covered the deposit known as the F.L. The company then proceeded with a systematic drilling program and in 1960, construction of a mining camp and preparations for an open pit operation began. By 1962, surface preparation was completed and a mill was setup with shipping facilities in Zeballos. The first shipment of magnetite concentrate was in May and total concentrate production for the year was 250,397 tons (227,155 tonnes) (MMAR, 1962). Operations were suspended for the majority of 1963 while the company was restructured and preparations for underground mining were made. Mining commenced again in 1964 and continued until 1968. At that time the economic limit of mining was reached. Mining concluded late that year and cleanup and processing of stockpile ore continued through to 1969. The mine was subsequently closed and all material removed from the property. The total amount of concentrate shipped for the period of 1962 to 1969 was 1,413,420 tons (1.28 million tonnes). (MMAR, 1962 - 69) During production, the magnetite concentrate averaged 60 percent iron (MMAR, 1960). Since the closing of the mine, no further work has been reported on the property.

KLAANCH , NIMPKISH IRON   57   MINFIL: 92L 034
TYPE: Skarn   NTS: 92L 06
Past Producer   LAT: 50 19'   LONG: 126 48'
Figure: 13, 14

The Klaanch deposit is a small magnetite skarn along the contact between Quatsino limestones and Karmutsen volcanics which have been intruded by a zoned stock of the Bonanza Group. The stock varies from gabbro in the centre to quartz - monzonite at the margin. It is the quartz - monzonite portion which intrudes the Klaanch deposit. The contact of the limestones and tuffs is near vertical and strikes roughly northwest. In several places the contact is offset short distances by faults. The limestone has been extensively recrystallized and bedding features have been eliminated. Mineralization extends over about 1000 feet (305 m.) in four discrete pods.

Mineralization is confined mainly to the volcanics and intrusive. Only a minor portion of limestone is replaced by skarn. The skarn is comprised of garnet, epidote, and magnetite. The margins of the ore zones appear to be brecciated host rocks with skarn healing the cracks. Contained within the magnetite are lenses and disseminations of pyrite and chalcopyrite. These sulphides are contemporaneous with skarn mineralization although there was a later phase of minor pyrite mineralization. Associated with the late pyrite is calcite which was precipitated in a crackle breccia throughout the skarn. Contacts of skarn with host rocks are gradational, irregular, and are comprised mostly of garnet and epidote.

The ore zone was comprised of four discrete bodies. The two main bodies are connected by a narrow band of skarn along the limestone - quartz monzonite contact. A significant portion of the mineralization is an embayment within the stock while the rest replaces volcanics and some limestone. A third ore zone occurs to the northwest along the volcanic - limestone contact. primarily as replacement of tuffs. These three zones extended over 1000 feet (305 m.) of strike and about 500 feet (153 m.) of width at surface (MMAR, 1961). Mineralization extended to a maximum of 200 feet (61 m.) of depth (MMAR, 1959, pp. 134). The fourth body occurs in limestones east of the main zone and was mined as an ancilliary pit during surface preparation (MMAR, 1961, pp. 93).

Magnetite was first discovered in the area of the Nimpkish River in 1897. The first reports of a magnetite deposit were in 1910 after a dip needle survey in the area of several magnetite outcrops pinpointed four separate magnetic anomalies. As the surface showings were small, no further development work was done. In 1955, the Nimpkish Iron Mines Ltd. optioned the claims which covered the magnetite showings and magnetic anomalies. The company promptly began a diamond drilling program to

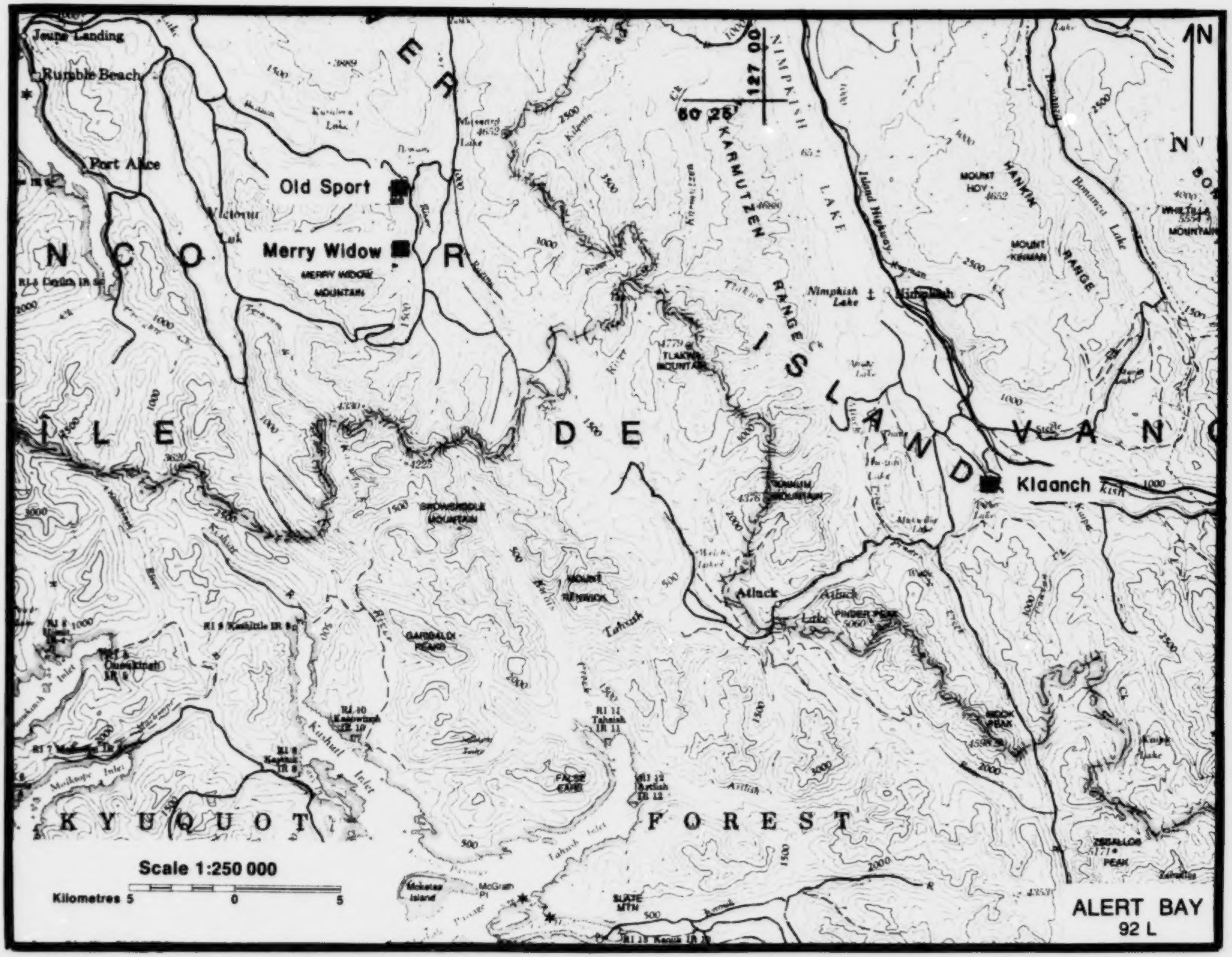

Old Sport
Merry Widow
MERRY WIDOW MOUNTAIN
Klaanch
Port Alice
Rumble Beach
Jeune Landing
NIMPKISH LAKE
KARMUTZEN RANGE
Island Highway
Nimpkish Lake
Atluck
Atluck Lake
PINDER PEAK 5060
MOUNT HOY 4652
MOUNT KINMAN
HANKIN RANGE
Bonanza Lake
TLAKWA MOUNTAIN
MOUNT RENWICK
GARIBALDI PEAKS
SNOWSADDLE MOUNTAIN
ZEBALLOS PEAK
WHITTLE MOUNTAIN
KYUQUOT FOREST
ILE DE VANCOUVER ISLAND
127 00
50 25
Scale 1:250 000
Kilometres 5 0 5
ALERT BAY
92 L
N

Figure 13 : Location of the Old Sport, Merry Widow, and Klaanch mines

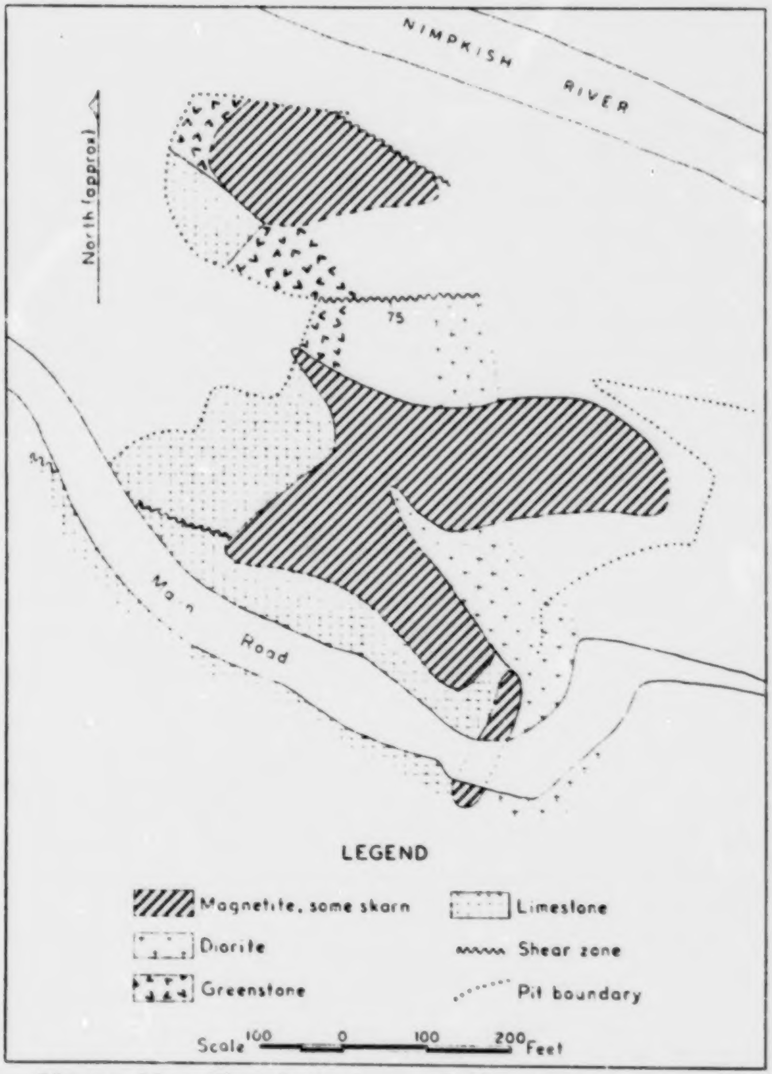

NIMPKISH RIVER
North (approx)
75
Main Road
LEGEND
Magnetite, some skarn
Limestone
Diorite
Shear zone
Greenstone
Pit boundary
Scale 100 0 100 200 Feet

Figure 14 : Sketch geology of the Klaanch deposit
(after EMPR Annual Report, 1961)

determine the size of the deposit. Exploration continued through to 1959 when preparation for mining began. By the end of 1959 the mine was in operation and had produced 8,123 tons (7,369 tonnes) of magnetite concentrate. Production continued until 1963 when the deposit was mined out. Total production for the period was 1,385,073 tons (1.26 megatonnes) of magnetite concentrate shipped (MMAR, 1963, pp. 99). After the mine closed no further work is reported.

OLD SPORT , BENSON LAKE S8	MINFIL: 92L 035
TYPE: Skarn	NTS: 92L 06
Past Producer	LAT: 50 23' LONG: 127 14'
Figure: 13, 15	

The Old Sport mine site is immediately south of Benson Lake on northern Vancouver Island. It is a very large, continuous magnetite deposit that produced almost three million tons of ore from underground workings during its ten year production life. The underground workings extend for a total of about eight kilometres representing ten years of development and ten years of production. The mine has had a long development history and may still have some undeveloped reserves.

The deposit occurs along the contact between Karmutsen volcanics and Quatsino Limestones. Underlying the deposit at depth and exposed near the mine is a large intrusion of the Coast Intrusive series. In the vicinity of the mine it is a diorite to quartz diorite. The limestones and volcanics strike northwesterly and dip about 30 degrees to the southwest. The deposit is localized in a single limestone layer 100 feet (31 m.) thick between the underlying Karmutsen volcanics and an overlying andesite flow; these are overlain by the Quatsino limestones. The ore mineralization follows the bottom contact, varies from 40 to 80 feet (12 to 24 m.) thick and has been traced for 6000 feet (1,830 m.) along strike, although only 3000 feet (915 m.) of strike length were developed (MMAR, 1960, pp. 101). Both the limestone and the volcanics have been altered by the intrusion of the diorite stock. Limestones have been recrystallized and bedding features have been completely obliterated. The volcanics, primarily basalts, have been pervasively altered to epidote and chlorite. The host rock alteration is always in sharp contact with the skarn mineralization and gradational contacts are not observed. The only structures in the deposit are faults but offsets are generally less than one metre.

The skarn mineralization is generally confined to the limestone, but small amounts of the lower volcanics have also been altered. Skarn consists mainly of garnet and epidote with less abundant actinolite, quartz, and serpentine. These skarn minerals occur generally as dense crystalline masses. Contacts with host rocks are very distinct, showing no gradation into the host.

The main part of the deposit which was developed extended for 3000 feet (915 m.) along strike, 2000 feet (610 m.) down dip , and averaged 60 feet (18 m.) in thickness (MMAR, 1931, pp. A169 - 70). Mineralization consists of large bodies of magnetite, almost free of skarn minerals, with smaller contained pods of chalcopyrite. At the lower levels nearer to the intrusion, bornite is found with the chalcopyrite. Between the cleaner masses of magnetite, skarn minerals are well mixed with disseminations of magnetite, chalcopyrite, and pyrrhotite. It was observed that the pyrrhotite tended to be more prevalent where the ore body is nearer to the diorite intrusion. (MMAR, 1927, pp. C347 ; Dolmage, 1918, pp. 358)

The Old Sport claim was first staked in 1897 by settlers who recognized showings of chalcopyrite in magnetite. The Consolidated Mining and Smelting Company of Canada Ltd. optioned the Old Sport group in 1916 and began development of the property as a copper prospect. The company trenched the surface over 3000 feet (915 m.) and by 1931, almost six kilometres of underground development had been done over seven levels (MMAR, 1931). No ore was produced during the development period and the property then remained idle until 1956. In 1960, interest was renewed in the property and development of a copper - iron mine began. In 1962 the first shipments of copper and iron concentrates were made. The ore was mined for the high grade chalcopyrite - bornite lenses in magnetite so low grade magnetite was waste rock or left underground. In 1970, the iron concentrate circuit was abandoned and only copper was produced until the closure of the mine in 1972, when the economic limit of copper ore was reached. The total production for the period 1962 to 1972 was 2,900,366 tons (2.63 megatonnes.) of ore treated (GEM, 1972, pp. 289 - 90). Since the closure of the mine no work has been done on the property.

MERRY WIDOW , KINGFISHER S9

MINFIL: 92L 044
TYPE: Skarn
NTS: 92L 06
Past Producer
LAT: 50 21' LONG: 127 14'
Figure: 13, 16

The Merry Widow deposit is located about 3 kilometres south of the Old Sport mine. Although the properties adjoin one another, their local geology is fundamentally different. The Merry Widow deposit is a magnetite skarn at the contact between the Quatsino limestones and the overlying Bonanza volcanics. The Kingfisher zone occurs 1000 feet (305 m.) northeast of the main Merry Widow zone and is exclusively contained in limestone.

The Quatsino limestones are thick bedded and strike north to northwest and dip to the southwest. Bedding features are preserved near the top of the unit but are lost down section due to recrystallization. The overlying Bonanza volcanics, west of the limestone, locally grade from clastic layers into volcaniclastics and flows. Where clastic layers are absent, the flows and volcaniclastics are in direct contact with the limestones. Diorite dykes intrude the Bonanza Volcanics and are believed to be comagmatic with the volcanics.

A large diorite stock intrudes the volcanics to the west and locally rotates bedding to the northeast. This stock is part of the Coast Intrusive sequence. The contact of the stock with the volcanics dips steeply to the east and contorts bedding of the limestone and volcanics at depth.

The Merry Widow deposit consists of two ore zones, both structurally controlled. The first and largest ore body is located along the volcanic - limestone contact where the diorite stock has warped the bedding to the northeast and turned it upright. The second ore body is localized in a branched breccia pipe of limestone within the plane of a vertical fault. No significant amounts of mineralization are found beyond the two zones.

Skarn mineralization is not well developed at the Merry Widow property. The skarn mineral assemblage consists of garnet, epidote, and actinolite. Some skarn is found along the contact between the limestone and volcanics near magnetite mineralization. Elsewhere, skarn is present as small pods and aggregates in the limestone but is not extensive. Rinds of skarn mineralization along the margins of the magnetite are sporadic and thin. It appears that the skarn assemblage was emplaced before the magnetite and some has been lost to the later phase of mineralization.

Mineralization consists of massive magnetite, which in the Merry Widow Zone, has replaced volcanics. It occurs as thick lenses which are

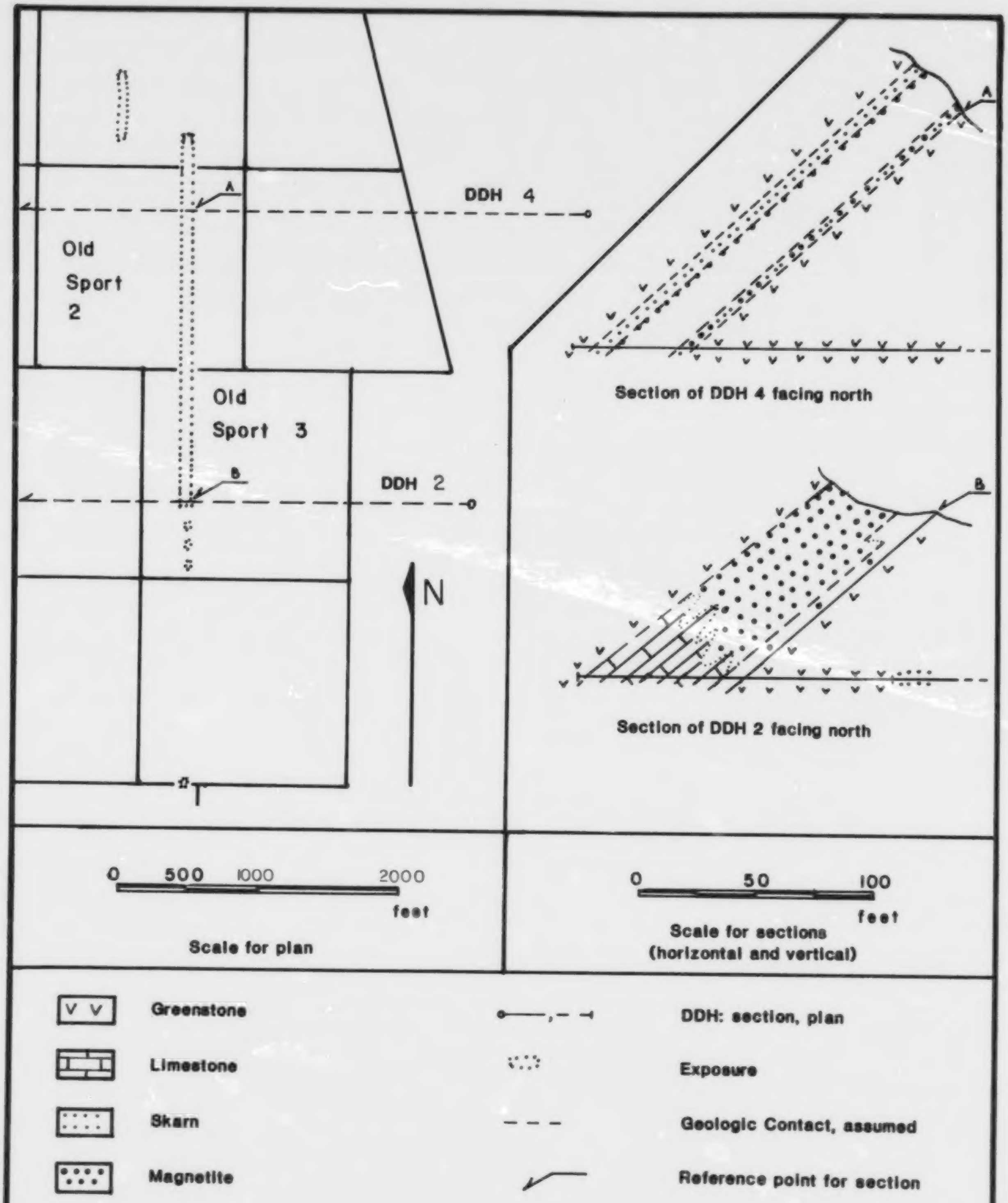

Old
Sport
2
Old
Sport 3
A
B
DDH 4
DDH 2
N
Section of DDH 4 facing north
Section of DDH 2 facing north
0 500 1000 2000
feet
Scale for plan
0 50 100
feet
Scale for sections
(horizontal and vertical)
Greenstone
Limestone
Skarn
Magnetite
Cu ore Zone
DDH: section, plan
Exposure
Geologic Contact, assumed
Reference point for section
DDH
Diamond Drill Hole

Figure 15 : Sketch geology of the Old Sport deposit
(after Quatsino Mining Co. maps, 1932)

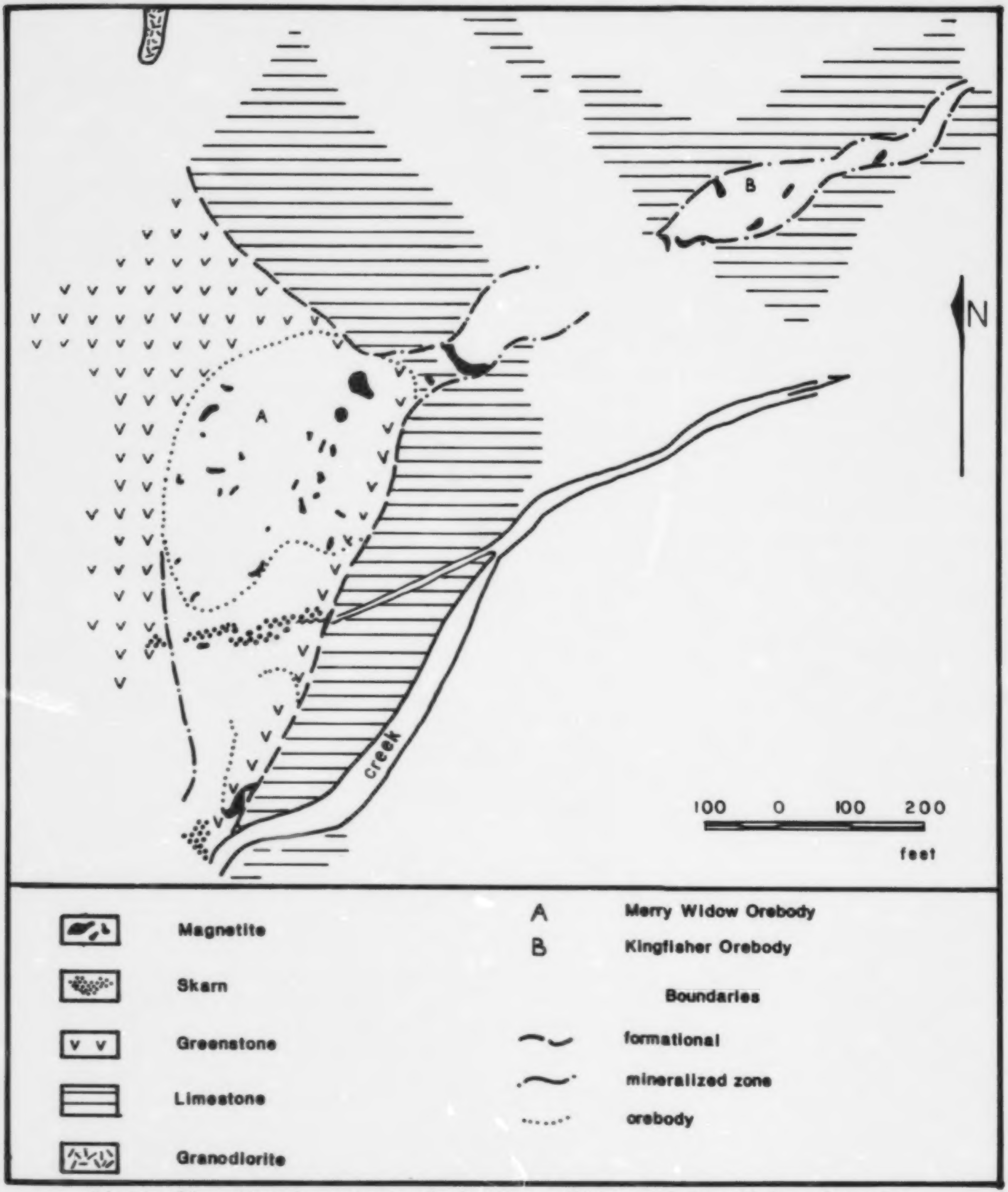

B
N
A
Creek
100 0 100 200
feet
Magnetite
Skarn
Greenstone
Limestone
Granodiorite
A Merry Widow Orebody
B Kingfisher Orebody
Boundaries
formational
mineralized zone
orebody

Figure 16 : Sketch geology of the Merry Widow and Kingfisher deposits
(after EMPR Annual Report, 1952)

separated by host volcanics and sporadic pods of skarn that parallel the contact of the diorite stock. These lenses strike northeast parallel to bedding but crosscut bedding as they dip steeply to the east following the diorite contact. The magnetite occurs generally as dense, crystalline masses. The Merry Widow deposit is exposed at surface for 1,100 feet (336 m.) in length and up to 300 feet (92 m.) in width. (MMAR, 1952, pp. A230)

Magnetite in the Kingfisher zone occurs in a breccia pipe completely within the limestone unit. The pipe is "Y" shaped with the upper arms nearly circular and just over 100 feet (31 m.) each across. The arms join about 300 feet (92 m.) below the surface and then rapidly pinch out with increasing depth (Sangster, 1969). Small amounts of skarn enclose and are intermixed with the magnetite. The magnetite generally is dense and crystalline. Locally within the magnetite, small areas formed as colloform pods instead of dense crystalline masses. This has lead to the theory that the magnetite was emplaced at low temperatures and pressures. It is also suggested that the magnetite was deposited by " gel metasomatism " (Stevenson and Jeffery , 1964). The mammillary form is restricted to magnetite emplaced in limestone.

Sulphide mineralization, generally scarce throughout the property, comprise abundant chalcopyrite, and trace pyrite, pyrrhotite, bornite and arsenopyrite. Where found, the sulphides occur as fine threads or disseminations in the magnetite and skarn. In a few localities, sulphides have been found in small pods within lenses of magnetite. As with the Old Sport mine, the sulphides generally appear to be later than the magnetite and skarn mineralization.

The Merry Widow property was staked on several magnetite showings in 1897, the same time as the Old Sport claims. A drill program commenced in 1951 and continued through to 1952 and delineated a large tonnage of magnetite. Preparation for a mine, mill and concentrator began soon after and in 1957 the first shipments of magnetite concentrate were made. Mining was by open pit from both the Kingfisher and Merry Widow bodies. In 1962 the surface reserve limit was reached and underground mining began. The mines continued operating through to 1967 when the economic limit was reached. Production for the period was 3,224,622 tons (2.93 megatonnes) of ore mined from the open pits and 492,167 tons (446,484 tonnes) of ore mined from the underground operation. Total production was 3,716,789 tons (3.37 megatonnes) of ore mined, the majority of which came from the Merry Widow body (MMAR, 1967, pp. 71). Since the completion of mining the property has remained idle.

INDIAN CHIEF MINE	S10	MINFILE: 92E 011	
TYPE: Skarn		NTS: 92E 08	
A Prospect		LAT: 49 26'	LONG: 126 18'
Figure: 17			

The Indian Chief claim group lies on Peacock Mountain, immediately west of Sidney Inlet, Vancouver Island. The claims cover an old high grade copper mine. The deposit is a skarn hosted in a roof pendant on top of a granodiorite intrusion.

Host rocks are limestone and volcanics of the Triassic Vancouver Group. Bedding strikes north and dips very steeply to the east. The limestones stratigraphically overlie the volcanics. Where the limestone has not been replaced by skarn, intricate small scale fold patterns are recognisable. The volcanics have undergone low grade metamorphism.

Skarn, which is composed of garnet, epidote and actinolite, preferrentially replaces limestone. Alteration is most intense near fault zones and where the limestone is in direct contact with the granodiorite intrusion (MMAR, 1917, pp. 250). Several major northwest trending and steeply notheast dipping step faults cut the deposit. Two smaller faults with a northeast trend transect the deposit. Skarn is most prevalent within 200 vertical feet (61 m.) of the pluton.

Metallic mineralization consists of magnetite, bornite, chalcopyrite, and pyrite. Mineralization, therefore, is unusual because of the large amount of bornite present, atypical for west Vancouver Island skarn deposits. High grade ore was restricted to the fault zones and where the limestone is in contact with the intrusive. Magnetite occurs throughout the skarn and was reported to be of sufficient quantity to be recovered after copper to make iron ore (----- ; 1920 ; pp. 20A - 21A).

The Indian Chief mine produced copper irregularilly due to its then remote location. The site was originally staked in 1897 and work continued, usually at a small scale, fairly steadily through to 1938. Since then there are only three reports of prospecting activity (MMAR, 1956; 1963; 1973). Otherwise it appears the site has remained untouched.

HETTY GREEN, COPPER KING S11 MINFILE: 92F 015
TYPE: Skarn NTS: 92F 04
A Prospect LAT: 49 14' LONG: 125 35'
Figure: 18

The Hetty Green claim lies on the east bank of Tofino Creek, about one kilometre from the head of Tofino Inlet. Host rocks are a complex greenstone series of diorites, granodiorites, basaltic porphyries, and granite. The available literature does not specify the names or ages of the stratigraphic units. These rocks may be of intrusive and/or volcanic origins (MMAR, 1963, pp. 113). Associated with the greenstone are layers of white to grey limestone. Layering (bedding ?) strikes northwest and dips steeply northeast (Company Map, ??; date ?). The greenstone series has been intruded by coarse grained, dark diorite sills. The area has been folded but only some small scale features have been mapped.

The exact distribution of skarn mineralization is not known but it does appear in varying amounts in the greenstone and intrusions in contact with limestone. Little or no limestone is replaced by the skarn. Skarn consists of garnet, epidote, pyroxene, amphibole, and calcite. The minerals are commonly coarsely crystalline and occur in masses and disseminations.

Within the irregular masses of skarn are pods and disseminations of the various metallic minerals that include magnetite, chalcopyrite, pyrite, pyrrhotite, with minor amounts of bornite and molybdenite. All these minerals can be found together in varying proportions. Molybdenite and magnetite are mutually exclusive. Sulphides often form small high grade pods within the skarn. Molybdenite is found only in two discrete zones and occurs as disseminated grains or ‘walnut-sized’’aggregates of molybdenite crystals. (MMAR, 1963, pp. 114)

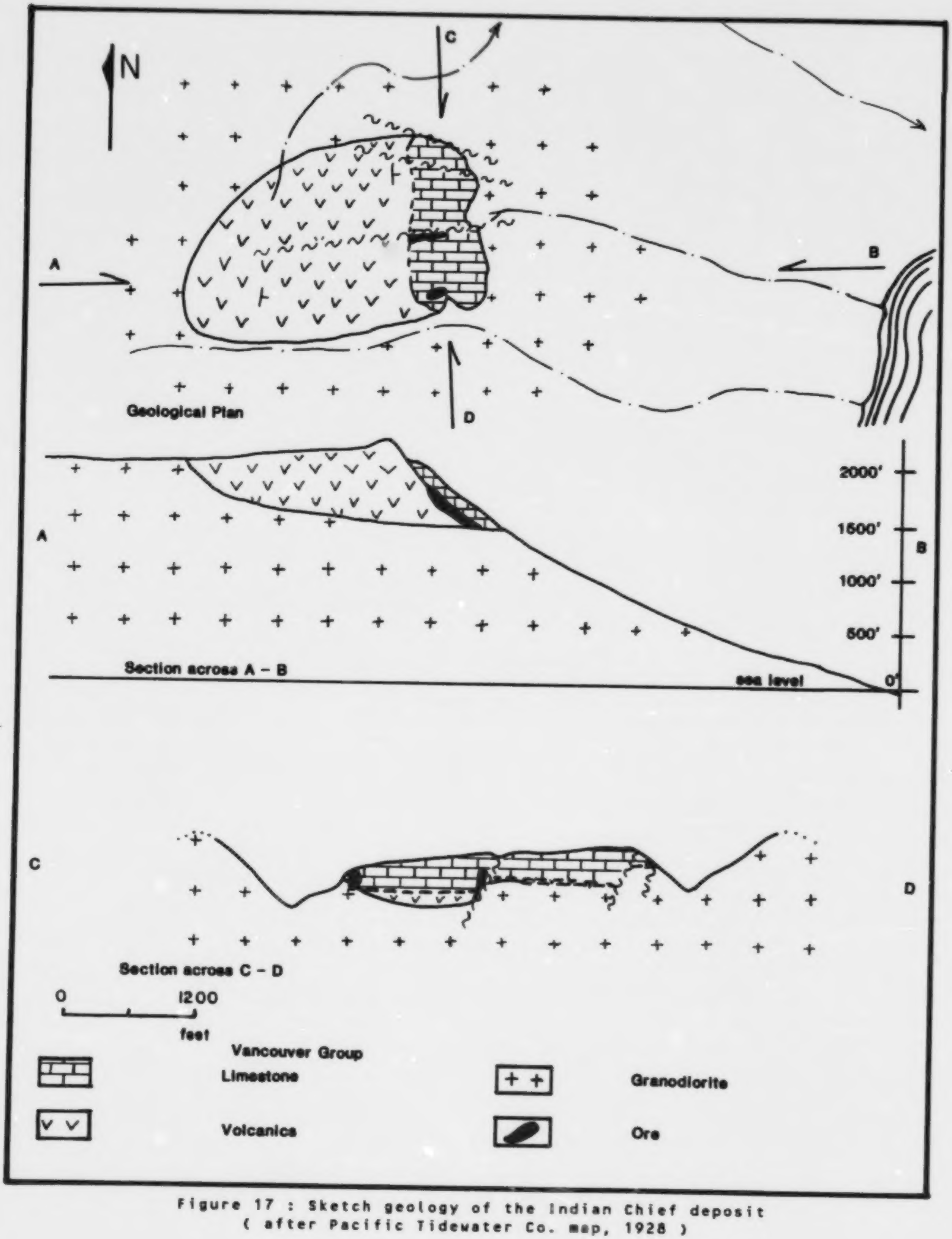

N
C
A
B
D
Geological Plan
2000'
1500'
1000'
500'
0'
A
B
Section across A - B
sea level
C
D
Section across C - D
0
1200
feet
Vancouver Group
Limestone
Volcanics
Granodiorite
Ore

Figure 17 : Sketch geology of the Indian Chief deposit
(after Pacific Tidewater Co. map, 1928)

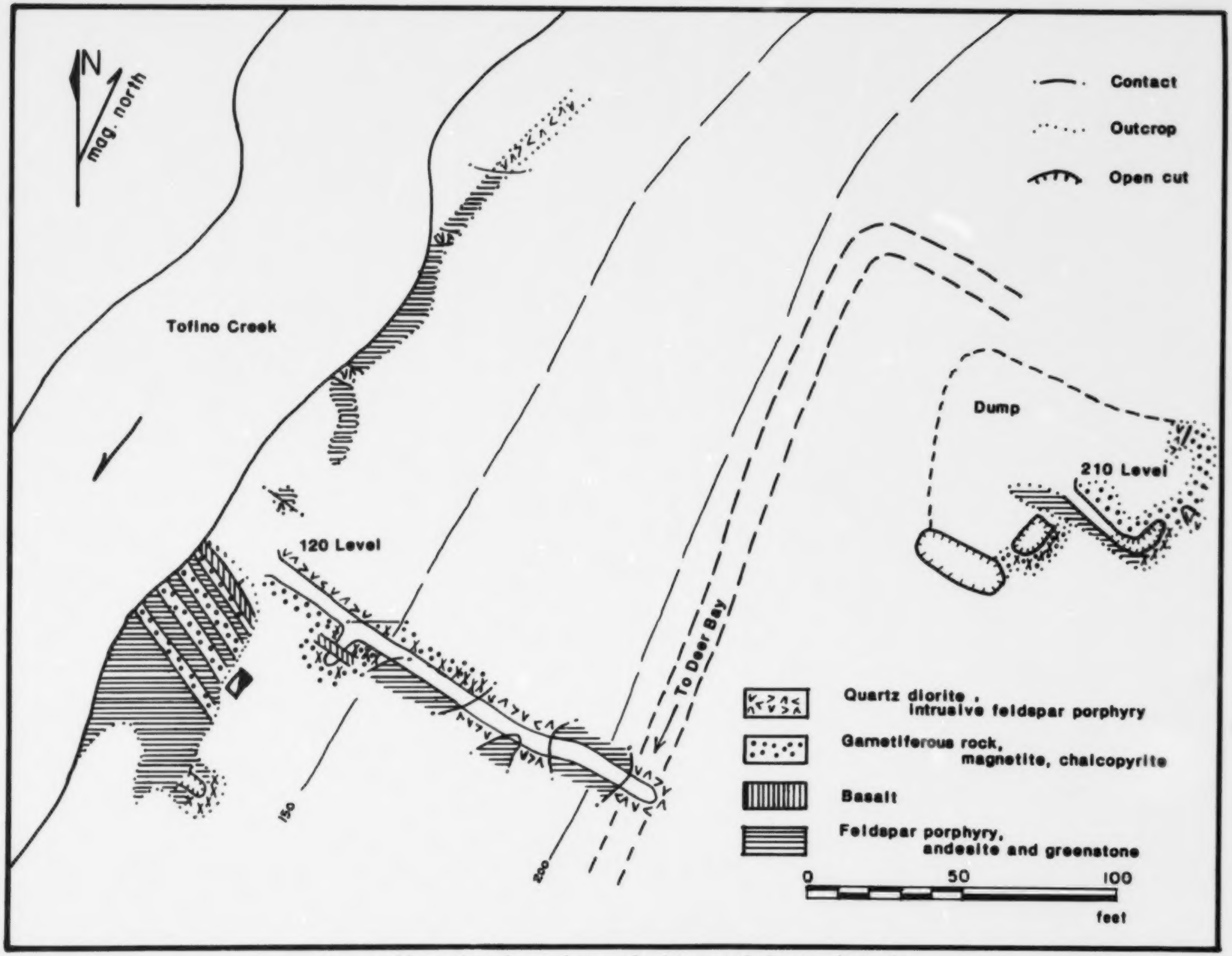

N
mag. north
Tofino Creek
120 Level
150
200
To Deer Bay
Dump
210 Level
Contact
Outcrop
Open cut
Quartz diorite , intrusive feldspar porphyry
Garnetiferous rock, magnetite, chalcopyrite
Basalt
Feldspar porphyry, andesite and greenstone
0
50
100
feet

Figure 18 : Sketch geology of the Hetty Green deposit
(after company map, author unknown)

Magnetite appears in significant quantities in the northwest and southeast ends of the mineralized zones. Magnetite occurs as masses and mineralized layers, often densely disseminated in stringers up to eight inches wide (20 cm.) with their lateral extent hidden under drift. A single face of massive magnetite 15 feet by 30 feet also has been reported (MMAR, 1963, pp. 115 - 116).

The ground known as the Hetty Green was originally staked in 1898. The claim was allowed to lapse and since then there have been several restakings and the original claim location is not known. The property was initially developed in the early 1900's. A small quantity of high grade copper ore was shipped in 1905 (MMAR, 1905). Work continued intermittently through to 1930. Subsequently occasional exploraton work has been done in the area. In the early 1960's a small drill and trench program was carried out by Sun West Minerals Ltd.. (MMAR, 1963, pp. 111 116). Since then a only small amount of surface work was done to examine the extent of molybdenum mineralization. Most recently, the ground is known as the Foremost group (1972) of Sunwest Minerals Ltd..

IRON RIVER S12 MINFILE: 92F 076
TYPE: Skarn NTS: 92F 14
B Prospect LAT: 49 55' LONG: 125 26'
Figure: 19

The Iron River claim group lies 2.4 kilometres east of middle Quinsam Lake, on the Iron River in central Vancouver Island. The deposit is a large iron skarn with some associated copper.

Locally, Upper Triassic Quatsino limestones, Triassic Karmutsen volcanics and Tertiary Benson Formation sediments are present. The sediments are post mineralization and overlie the deposit to the southwest. Limestone lies to the north of the deposit and appears to be essentially unmineralized. Basic volcanic tuffs are the host rocks to the skarn deposit. A quartz diorite stock of the Coast Intrusive series has intruded the volcanics to the east of the skarn. As well, two small apophyses are present immediately adjacent to the skarn.

The skarn is mainly comprised of garnet with some epidote and actinolite ans is quite irregular in shape. The Iron River cuts through the middle of the deposit, creating east and west `zones'. The west zone is on a hill and is well exposed, but the east zone is on the flats below and is covered by drift.

Magnetite occurs as fine grained, irregularily shaped masses unmixed with skarn minerals. Some chalcopyrite, pyrite, and hematite are found with the magnetite but never in any significant amounts (Young and Uglow, 1926, pp. 71 - 73). Drilling done in 1956 has delineated an estimated 800,000 probable tons (725,744 tonnes) of iron ore. Assayed samples of ore yielded an average of 36 percent iron, 0.9 percent sulphur, and 0.35 perent copper. (MMAR, 1956, pp. 131) Work by Texada Mines Ltd. during 1965 and 1966 delineated approximately 4 million tons (3.6 megatonnes) of iron ore (Property Report, 1973). The grade and type of ore (proven, possable , probable) were not specified.

The early history of the property is not known. Examination of the property by Young and Uglow (1926) indicate that by 1926 and adit had been driven 60 feet (18 m.) into the west ore body. At the time of inspection the adit was already caved and inaccessible The more recent reports state that drill work was done in 1954 to 1956. Subsequent to that, Texada Mines Ltd. did further mapping and drilling in 1965, 1966 and 1971 (MMAR, 1965; 1966; 1971). There are no later reports of activity on the claims.

CROWN PRINCE, Sechart Pen. S13 MINFILE: 92C 002
TYPE: Skarn NTS: 92C 14
A Prospect LAT: 48 58' LONG: 125 13'
Figure: 20

The Crown Prince showings extend across the Sechart Peninsula in Barkley Sound. The group of claims includes the Iron Chief, Bald Eagle, and Lord of the Isles Crown Granted claims, as well as several others. The deposit is a typical west coast Vancouver Island iron skarn with magnetite as the major mineral present.

The deposit is hosted in a raft of limestone and andesitic tuffs, assigned to the Vancouver Group (Young and Uglow, 1926), in a pluton of Beale hornblende diorite. Bedding strikes approximately east - west and dips variably to the north. Locally the bedded package is cross cut by late dykes of quartz monzonite and granite.

In the mineralized zone, limestone has been almost completely replaced by garnet - epidote skarn whereas tuffs show only a minor amount of alteration. The degree of skarning is variable and irregular in size and shape. The whole zone extends over an area greater than 7000 feet (2135 m.) along strike and 1000 feet (305 m.) of width (after Noranda map, 1961).

Magnetite is found most commonly as bedding parallel lenses. It also occurs as disseminations and pods throughout the skarn. Individual exposures of magnetite mineralization are 10 to 70 feet (3 to 21 m.) across. A shallow shaft on the Iron Chief claim shows magnetite to be 15 to 20 feet (4.5 to 6 m.) deep (Young and Uglow, 1926, pp. 215). Young and Uglow have separated the magnetite into three types: greater than 70 percent magnetite by volume, 50 - 50 magnetite and gangue, and less than 20 percent magnetite (op. cit., pp. 208). Most of the showings fall into the first two categories. An assay of ore type rock from the Crown Prince claim yielded 56.6 percent iron, 0.72 percent sulphur, no phosphorous, and 19.0 percent silica (ibid.).

The Crown Prince and neighbouring claims were staked prior to 1901. Prospecting, stripping and adit drifting was done on the properties over the next 20 to 25 years. Then the area appears to have remained idle until just before 1961. At that time some unrecorded assessment work was done. Then in 1961, Noranda Exploration Ltd. did a surface assessment of the iron deposit. Subsequent to that, no further work has been reported.

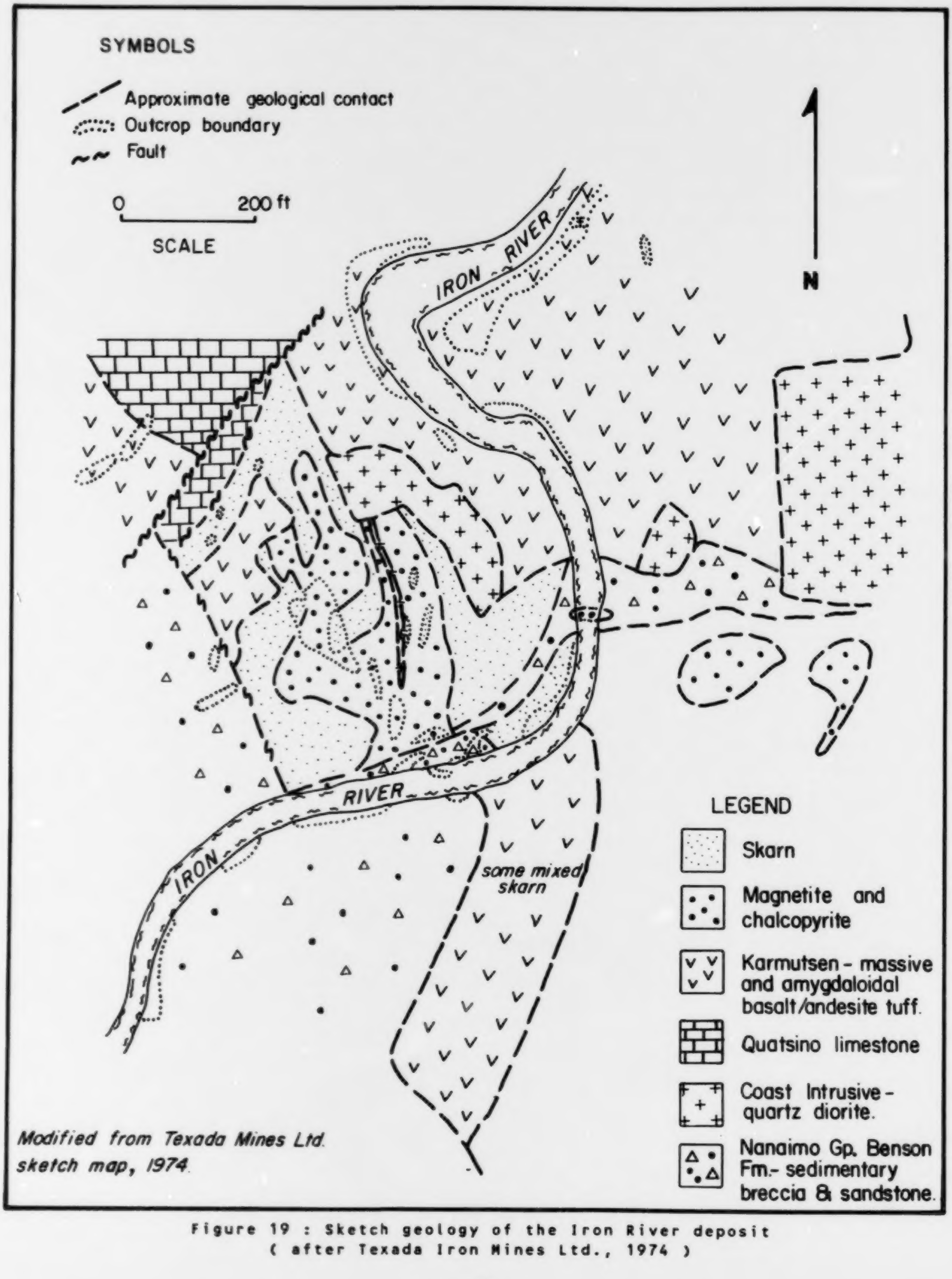
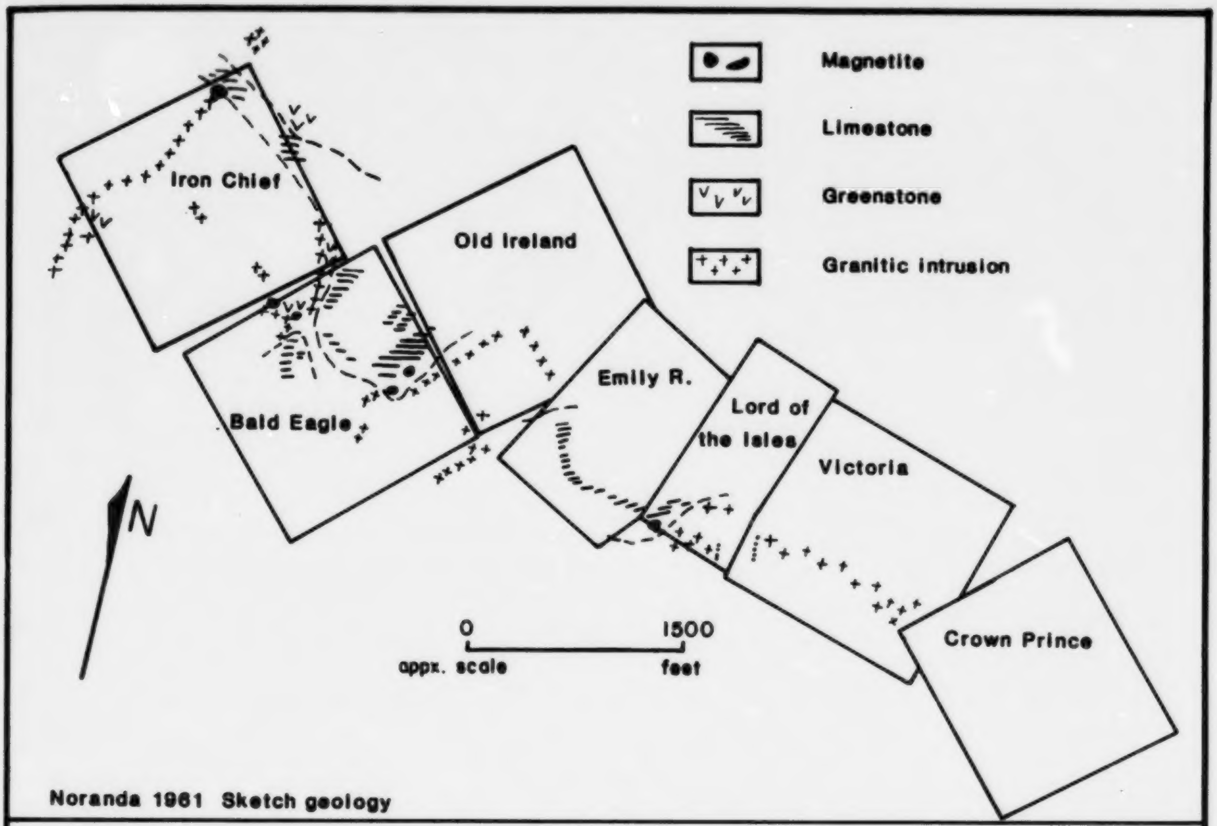
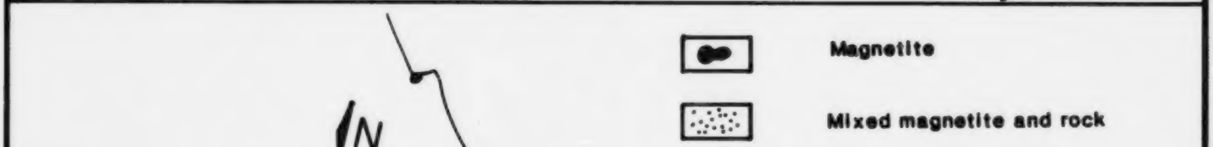

SYMBOLS
Approximate geological contact
Outcrop boundary
Fault
0
200 ft
SCALE
N
IRON RIVER
RIVER
IRON
some mixed skarn
LEGEND
Skarn
Magnetite and chalcopyrite
Karmutsen - massive and amygdaloidal basalt/andesite tuff.
Quatsino limestone
Coast Intrusive - quartz diorite.
Nanaimo Gp. Benson Fm.- sedimentary breccia & sandstone.
Modified from Texada Mines Ltd. sketch map, 1974

Figure 19 : Sketch geology of the Iron River deposit
(after Texada Iron Mines Ltd., 1974)


Magnetite
Limestone
Greenstone
Granitic intrusion
Iron Chief
Old Ireland
Bald Eagle
Emily R.
Lord of the Isles
Victoria
Crown Prince
N
0
1500
appx. scale
feet

Noranda 1961 Sketch geology


Magnetite
Mixed magnetite and rock
Tuff
Granite
Cabin
N
860
800
740
Plan of Tunnel, geology as on the roof
50
0
100
200
feet

Young and Uglow 1926 Sketch geology

Figure 20 : Sketch geology of the Sechart Peninsula (Crown Prince) iron showings (after Noranda Exploration Ltd., 1961 and Young and Uglow, 1926)

CONQUEROR, DANIEL S14 MINFILE: 92C 022
TYPE: Skarn NTS: 92C 09
A Prospect LAT: 48 39' LONG: 124 29'
Figure: 21

The Conqueror and Daniel Crown Granted claims lie on Bugaboo Creek, 13 kilometres north northeast of Port Renfrew. Included in this descripton are the David, Sirdar, Little Bobs, and Baden Powell Crown Grants. All of these claims cover a series of magnetite showings along the same mineralized system.

Mineralization is hosted in roof pendants of limestone in an upper Jurassic diorite intrusion of the Coast Intrusive Series. The result is a string of large mineralized rafts on an unroofed pluton.

Skarn occurs along the contact of the limestone and diorite, almost completely replacing the former. It appears to be of two phases. The first is an older garnet - epidote assemblage now found only as remnants within massive magnetite; the second is a later pyroxene skarn that surrounds the massive magnetite (MMAR, 1959, pp. 140).

Magnetite occurs as large, irregular massive bodies entirely surrounded by skarn. It is essentially free of any impurities and only has a small percentage of included sulphides. Assays of the magnetite yielded grades up to 69.2 percent iron with 0.5 percent sulphur (MMAR, 1902, pp. H220). More recent assays indicate an average of 55.01 percent iron and 3.04 percent sulphur (Menzies, 1960). The only sulphides present are pyrite and chalcopyrite.

Drill work by Noranda Exploration Ltd. in 1959 and 1960 delineated two significant iron ore bodies. These lie on the Conqueror and Daniel claims. Reserve figures for the the two deposits are:

Indicated Reserves:
    Daniel (open pit) : 1,695,000 tons
        (1.53 megatonnes)
    Conqueror (underground): 1,179,000 tons
        (1.07 megatonnes)

    Total : 2,874,000 tons

Probable Reserves:
    Daniel : 561,000 tons
        (0.51 megatonnes)
    Conqueror : 500,000 tons
        (0.45 megatonnes)

    Total : 1,061,000 tons
        (0.96 megatonnes)

Possable Reserves:
    Conqueror : 880,350 tons
        (0.80 megatonnes)

(after Menzies, 1960).

Following exploration by Noranda Exploration Ltd., it appears that no further development work has been done. The other claims in the area, David, Baden Powell, etc., all have large outcrops of magnetite. Development on them is limited to stripping and trenching in the early 1900's so the extent of mineralization is not well known. However the workings have shown surface exposures up to 100 feet (30 m.) long and tens of feet across. Since the work in 1959 and 1960, there have been no further reports of activity on the claims.

SARITA S15 MINFILE: 92C 032
TYPE: Skarn NTS: 92C 15
A Prospect LAT: 48 53' LONG: 125 00'
Figure: 22

The Sarita iron prospect is approximately 20 kilometres northeast of Bamfield, on Pachina Creek near the Sarita River. The deposit is comprised of a series of iron skarn showings in limestone.

The host limestone is flat lying and is intruded by Beale hornblende diorite (Young and Uglow, 1926). Locally the limestone has been replaced by garnet skarn.

Magnetite, found along the limestone - diorite contact, is partly surrounded by skarn but is also found in direct contact with recrystallized limestone. The showings follow a long, arcuate line that is convex to the south and trends east - west over 1000 feet (305 m.). The magnetite is massive and generally free of any impurities. Pyrite is found only occasionally as disseminations or microveins in the magnetite. An assay of `good ore' yielded 63.7 percent iron, 0.3 percent sulphur, trace phosphorous, and no titanium (MMAR, 1902, pp. H217). An assay from a shipment of ore in 1922 yielded 52.4 percent iron, 0.2 percent sulphur, trace phosphorus, and no titanium (MMAR, 1922, pp. 226).

The property was originally staked prior to 1896. Development consisted of strippings and trenches over 1000 feet (305 m.) on showings of magnetite. A large bluff of magnetite, 60 feet high and 92 feet wide (18.3 by 28 m.), was the main target. An adit driven near the bluff extended circuituosly along the ore contact for 268 feet (82 m.) (MMAR, 1902, pp. H215). In that adit, a winze was sunk nine feet (2.7 m.) in ore. Development continued through to 1922 at which time a shipment of 10 tons (9 tonnes) of ore was made. Following that there are no reports of activity until 1961. In that year the Empire Development Co. Ltd. evaluated the iron potential of the property. At this time it was found that a portion of the early claims and the adit lie within the bounds of an indian reserve (MMAR, 1961, pp. 111). . Then from 1979 to 1981, Nomad Energy and Mines Ltd. completed a drill program for gold in the area. The most recently, Tenquille Res. Ltd. began a gold exploration project in 1987 (George Cross Newsletter, #8, 13 Jan., 1987). Except for the ore shipment in 1922, it appears that the iron deposit remains untouched.

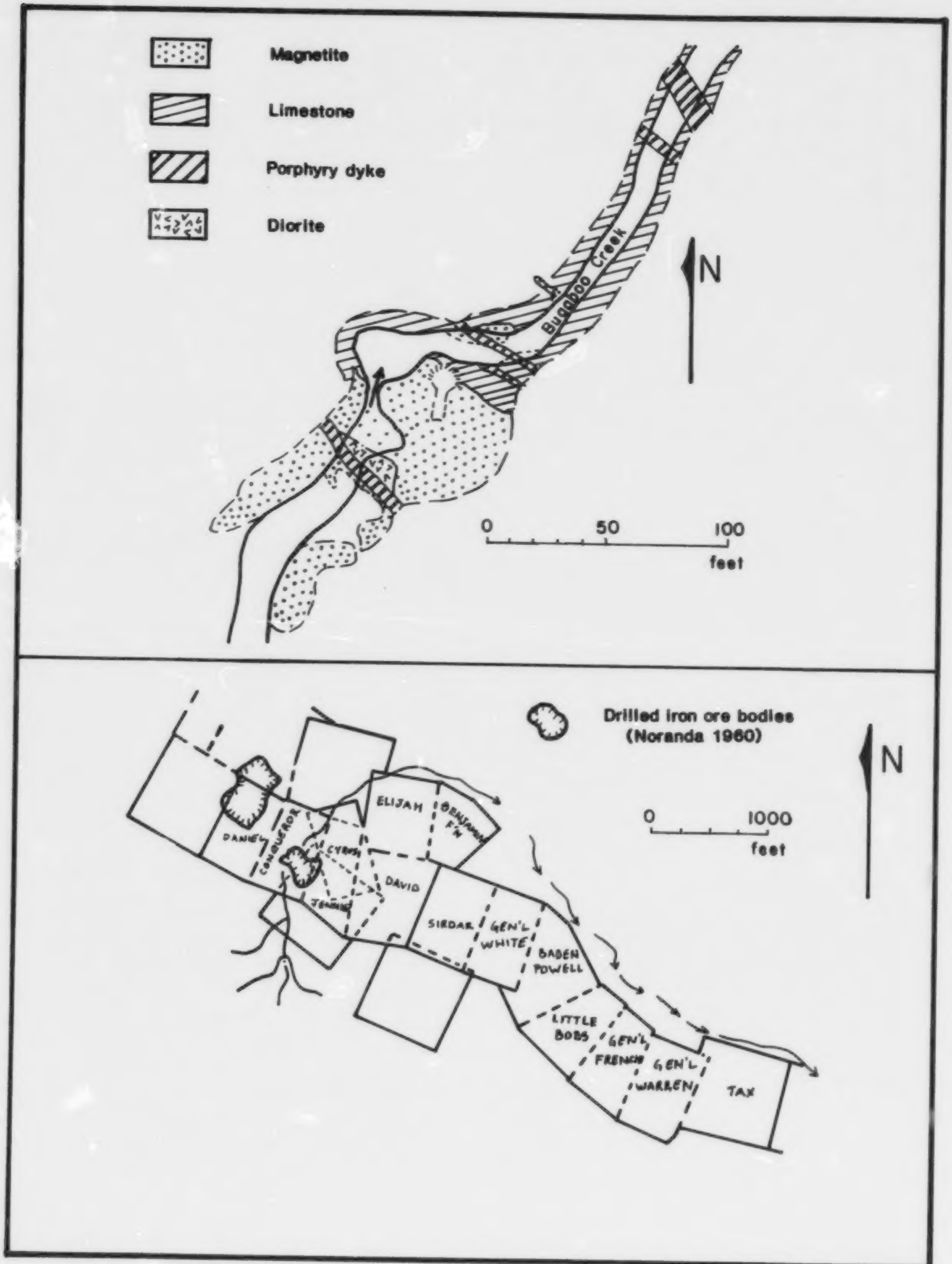

Magnetite
Limestone
Porphyry dyke
Diorite
Bugaboo Creek
N
0
50
100
feet
Drilled iron ore bodies
(Noranda 1960)
N
0
1000
feet
DANIEL
CONQUEROR
CYRUS
ELIJAH
BENJAMIN F'N
DAVID
JENNIE
SIRDAR
GEN'L WHITE
BADEN POWELL
LITTLE BOBS
GEN'L FRENCH
GEN'L WARREN
TAX

Figure 21 : Sketch geology of the Conqueror and Daniel deposits (after Menzies, 1960 and Young and Uglow, 1926)

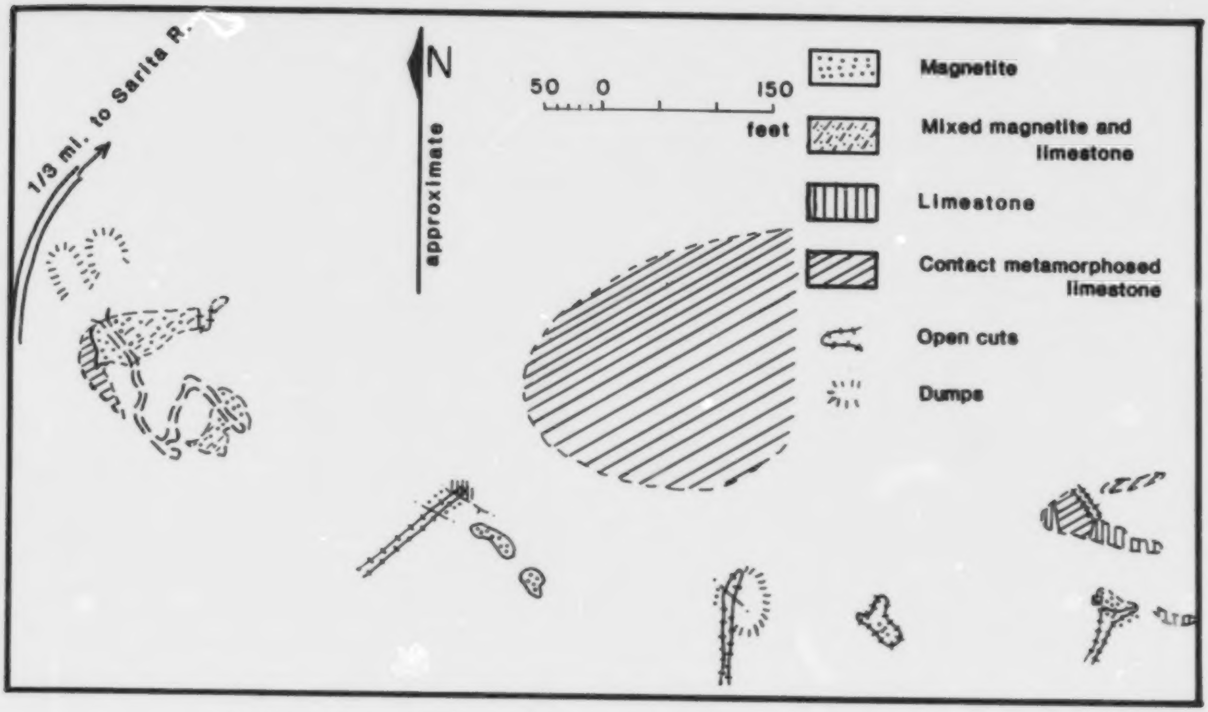

1/3 mi. to Sarita R.
N
approximate
50 0 150
feet
Magnetite
Mixed magnetite and limestone
Limestone
Contact metamorphosed limestone
Open cuts
Dumps

Figure 22 : Sketch geology of the Sarita River deposit
(after Young and Uglow, 1926)

REKO 3, REKO 10 S16 MINFILE: 092C 90 / 91
TYPE: Skarn NTS: 92C 09
A Prospect LAT: 48 39' LONG: 124 18'
Figure: 23

The Reko 1 to 65 claim group lies at the head of Renfrew (Granite) Creek, 10 kilometres northeast of the old B.C. Forest Products logging base camp at the head of Port San Juan Inlet, Vancouver Island. The claims cover a series of iron skarn showings.

Magnetite is hosted in Quatsino limestones and Karmutsen volcanics that have been intruded by a large, locally autobrecciated, diorite pluton (Eastwood, 1974). The limestone is blue - grey and has been extensively recrystallized. Bedding features, when found, indicate the limestone forms an asymetric, northwest plunging synform that is distorted by the underlying intrusion. The limestone is cut by andesite dykes, many of which are skarn altered, and by later unaltered leucocratic dykes. Stratigraphically below the limestone are andesitic volcanic rocks. These rocks have been substantially brecciated, most probably by the intruding diorite. The volcanic rocks are cut by the same suite of dykes as the limestone.

Skarn mineralization is generally confined to brecciated volcanics and intrusions, often terminating abruptly against the limestone or forming a thin rind at the limestone - volcanic contact. The calc - silicate assemblage is pyroxene, epidote, and garnet. Skarn is found as scattered lenses and disseminations.

Magnetite is generally scattered as small pods, lenses and disseminations in all the local rock types. Of the eleven mineralized zones identified, five are potentially minable. Published reserve estimates are as follows :

Zone :	1	45,250 tons	(41,050 tonnes)
	2	1,070,000 tons	(970,682 tonnes)
	3	35,100 tons	(31,842 tonnes)
	5	38,250 tons	(34,700 tonnes)
	8	36,450 tons	(33,067 tonnes)
Total :		1,225,000 tons	(1,111,341 tonnes)

(after GEM, 1974, pp. 170).

The following figures are from unpublished preliminary calculations by P. Eastwood (BCDM) circa 1974 :

Zone :	1	49.3 percent iron
	2	37.5 percent iron
	3	51.4 percent iron
	5	41.0 percent iron

Cut off grade for reserve calculations is 30 percent iron and 0.2 percent copper.

The initial Reko 1 to 6 claims were staked in 1970 by Reako Exploration Ltd. on magnetite showings exposed by logging road development. By September of 1972, 62 more contiguous claims were staked around the original claims after encouraging surface work. A drill program was carried out from 1973 to 1975 to determine the extent of iron and copper mineralization. Copper values were about 0.2 percent and no precious metal values have been reported. No further exploration activity is reported.

COPPER ISLAND, MOUNTAIN S17 MINFILE: 92C 033
TYPE: Skarn NTS: 92C 14
A Prospect LAT: 48 56' LONG: 125 04'
Figure: 24

The iron claims on Copper Island (Tzartus Island) in Barkley Sound were first staked in 1894. The most significant iron showings are on the crest of the mountain at the north end of the island. The deposit is an iron skarn hosted in tuffs in contact with an intrusive diorite.

Host rocks to the mineralization are a sequence of andesite tuffs and an overlying interbedded unit of limestone and tuff of the Vancouver Group. Strata strike northwesterly and dip moderately to the northeast. Beale hornblende diorite intrudes the tuffs, forming the southern two thirds of the island The contact of the diorite with the tuffs trends roughly northwest - southeast. A later intrusion of granodiorite cuts the diorite and related dykes crosscut the older rocks.

The tuffs have been altered to a garnet - epidote skarn. This skarn follows the contact of the diorite and tuff. Magnetite, commonly intermixed with skarn minerals, is found as disseminations, thin sheets, pods and lenses parallel to bedding in the tuffs. Few showings of massive magnetite are known, with the largest being 10 feet (3 m.) thick with an undetermined lateral extent. The zone of mineralization extends for 560 feet (171 m.) along strike and 800 feet (244 m.) down slope (Young and Uglow, 1926, pp. 202). The largest development is a quarry 75 feet (23 m.) wide and 35 feet (11 m.) high. A shaft sunk in the floor of the quarry exposes magnetite for 10 feet (3 m.) (Lindeman, 1910, pp. 12). Most assays express values of 50 to 60 percent iron, 0.3 to 1.51 percent sulphur and no titanium (Young and Uglow, 1926, pp. 204).

The Copper Island deposit was prospected between 1894 and 1902. This consists of several open cuts, some stripping and an adit. Since the early prospecting work the only other report of activity is in 1961. At that time the Empire Development Co. Ltd. executed a drill examination of the property and delineated a small iron ore body. The specific information was not available to the author.

WILLORON S18 MINFILE: 92B 045
TYPE: Skarn NTS: 92B 12
B Prospect LAT: 48 37' LONG: 123 35'

The Willoron claim group lies on the north ridge of Wood Mountain, 22 kilometres north of Victoria. This is just above the old B.C. Cement plant on Saanich Inlet. The property covers a series of iron - copper skarn showings.

The regional host rock is a metamorphosed, interfingering contact zone of upper Jurassic Wark gabbro - diorite gneiss and Colquitz granodiorite gneiss. Locally contained within the zone are dissected remnants of limestone which have been identified as Sutton limestones by C. H. Clapp in 1913. More recent work suggests that this may be incorrect (N. Massey, BCMEMPR, pers. comm.). Rocks trend west northwest and dip steeply north or south. The limestone has been distorted and completely recrystallized by the intrusion of the gneissic complex (Clapp, 1913, pp. 173 - 188). It appears as lenses that vary from several meters wide and tens of metres long to several tens of metres wide and over 300 metres long (Aho, 1961). Later dykes of alaskite and andesite cross cut the older sequence.

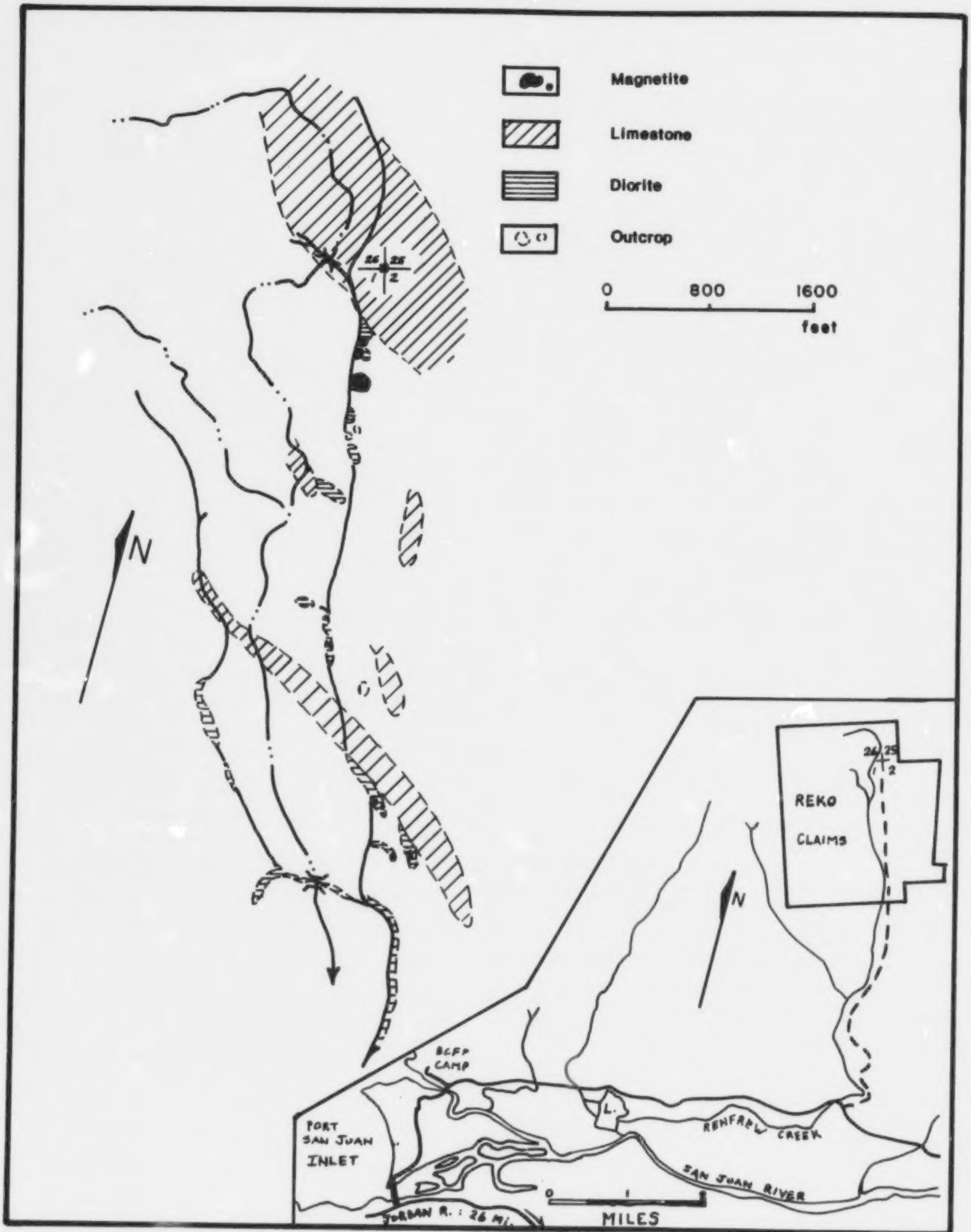
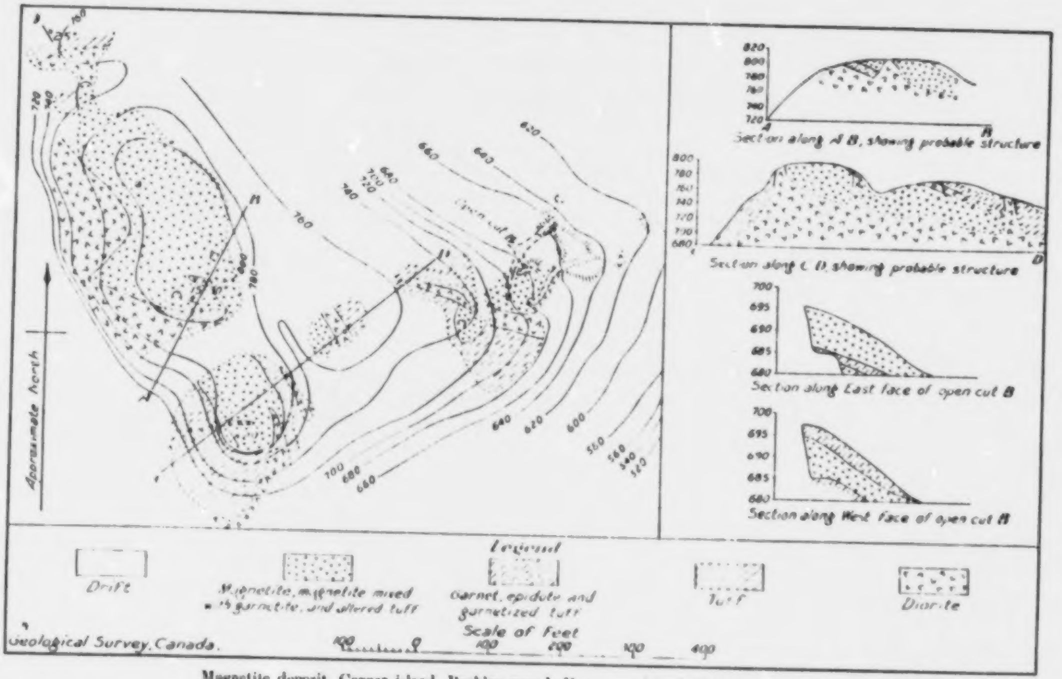
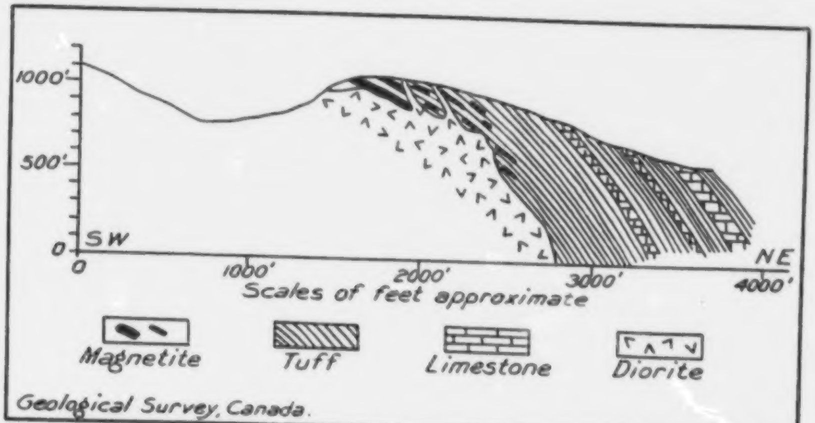

Magnetite
Limestone
Diorite
Outcrop
0
800
1600
feet
N
26
25
1
2
REKO
CLAIMS
BCFP
CAMP
PORT
SAN JUAN
INLET
L.
RENFREW CREEK
SAN JUAN RIVER
JORDAN R. : 26 Mi.
0
1
2
MILES

Figure 23 : Sketch geology and location of the Reko iron showings
(after Levasseur, circa 1972, Reako Explorations Ltd.)


Section along A B, showing probable structure
Section along C D, showing probable structure
Section along East face of open cut B
Section along West face of open cut B
Approximate north
Open cut B
Legend
Drift
Magnetite, magnetite mixed with garnetite, and altered tuff
Garnet, epidote and garnetized tuff
Tuff
Diorite
Scale of Feet
100 0 100 200 300 400
Geological Survey, Canada.

Magnetite deposit, Copper island, Barkley sound, Vancouver island, B.C. Contour interval, 20 feet.


1000'
500'
0
SW
NE
0
1000'
2000'
3000'
4000'
Scales of feet approximate
Magnetite
Tuff
Limestone
Diorite
Geological Survey, Canada.

Idealized section through Copper island. The magnetite (solid black) replacing beds of tuff close to underlying intrusive body of diorite.

Figure 24 : Sketch geology of the Copper Island iron deposit (after Young and Uglow, 1926)

Skarn alteration of the limestone is adjacent to or near its contact with the gneisses. Alteration appears as a typical garnetite with epidote and other calc - silicate minerals. There are many individual showings, each several meters wide and commonly elongate with the regional structure. Dip needle magnetic anomalies show extentions under the drift with the largest single anomaly 130 - 140 feet (40 - 43 m.) long and 50 (15 m.) wide. The series of anomalies extends along trend in excess of 1000 feet (305 m.). (Aho, 1961)

Mineralization in the skarns is of two types: [1] pyrrhotite, pyrite, with some chalcopyrite and [2] magnetite with some pyrite. Magnetite commonly occurs as massive pods and lenses but it is sometimes found variably mixed with skarn minerals (Aho, 1961). Assays yield a wide range of iron content, from 67.03 percent iron to 25.85 percent, but average values are between 40 and 60 percent iron. (ibid.)

Originally several separate claims covered the iron showings. These were the Jumbo, Eagle, Chemainus, Malahat, and Star claims. In 1902, several adits, trenches and some surface stripping had been done on the claims (MMAR, 1902, pp. 221 - 222). In 1961, A. E. Aho conducted a dip needle survey and surface mapping of the property. There are no subsequent reports of activity on the claims.

HAPPY JOHN S19 MINFILE: 92C 008
TYPE: Skarn NTS: 92C 15
B Prospect LAT: 48 59' LONG: 124 57'

The Happy John claims lie 27 kilometres west of Port Alberni, on the north shore of Alberni Inlet at Handy Creek. The Happy John claims adjoin the old Monitor high grade copper mine. The deposit is a copper - iron skarn along a limestone - volcanic contact.

Host rocks are northwest trending Quatsino limestones and basic Karmutsen volcanics (MMAR, 1918, pp. K256). Both these rock types have been variably altered to skarn with the limestones containing the majority of the mineralization. Cross cutting the host rocks is a younger diabase dyke that hosts some minor copper mineralization (ibid.).

Skarn mineralization has been traced along the contact for about 3000 feet (915 m.). It occurs as pods and lenses with one lens traced along strike for 400 feet (122 m.). Mineralization consists of magnetite, chalcopyrite, pyrite, and some pyrrhotite with rare arsenopyrite and gold. (ibid.). The initial interest was for copper so the magnetite is just mentioned. In general, most showings are natural outcrops so the continuity of mineralization is not well established. Two long adits and a shallow shaft have shown `good mineralization' (copper) to depth. (ibid.).

The Happy John claims were staked prior to 1900 and worked through to 1908. During that time a few adits and a shaft were driven as well as some surface stripping of some showings. (MMAR, 1918) The next report of activity is by the Island Mining and Exploration Co. Ltd., in 1974, on a group of claims just north of the Happy John. Some surface reconnaisance extended over the group but no other work is reported. (Malcolm, 1974)

STAR OF THE WEST S20 MINFILE: 92E 010
TYPE: Skarn NTS: 92E 15
B Prospect LAT: 49 56' LONG: 126 40'

The Star of the West claims lie on the west side of the head of Tahsis Inlet, 1.6 kilometres west of Tahsis village. The deposit is an iron - copper skarn in Quatsino limestone (MMAR, 1923, pp. K247).

The local package of limestone has been recrystallized to marble by an intrusion of granodiorite. Bedding trends northwest and is truncated by a diorite phase of the intrusion to the east and south of the property. Diorite extends into the limestone in a series of fingers which have created several skarn bodies. These are primarily composed of garnet and some epidote (op. cit., pp. K247 - 248).

The deposits are a series of pods contained within skarn. The target of exploration was the copper mineralization so the character of magnetite mineralization has not been described. Minerals present are magnetite, pyrite, chalcopyrite, and pyrrhotite. Chalcopyrite is mentioned to occur with the magnetite. The largest developed showing is a bluff 135 feet (41 m.) long (ibid.). Many well mineralized showings are present across the property.

The Star of the West claims were staked about 1922 and were extensively prospected until 1931. Exploration consisted of stripping, trenching, and driving a small adit. Later, two small drilling projects were done in 1955 - 56 and 1962, the results of which are not published. Then a small amount of surface mapping, geophysics, and geochemical sampling was done in 1970 and 1971. There has been no further work done on the claims.

WHITE, FOREMOST S21 MINFILE: 92F 009
TYPE: Skarn NTS: 92F 04
B Prospect LAT: 49 14' LONG: 125 35'

The White claim group cover a series of iron skarn showings on a hill slope, 3 kilometres up the west bank of Tofino Creek. The claims are just upstream from the Hetty Green claims.

The deposit is hosted in a flat lying unit of limestone between two volcanic successions of the Vancouver group. The limestone is approximately 100 feet (30 m.) thick and is tracable for 600 feet (183 m.) before being hidden under drift. It is exposed in a bluff that faces southwards and trends east - west. (MMAR, 1927, pp. C344 ; 1963, pp. 115)

Skarn alteration is limited to the limestone horizon with the whole vertical section exhibiting varying degrees of alteration. Minerals present include garnet, epidote, quartz, tremolite, pyroxene, and actinolite (MMAR, 1926, pp. A302).

Mineralization consists of chalcopyrite and magnetite with some pyrite, pyrrhotite, and bornite scattered through the iron - copper masses. The sulphides and magnetite are found as pods and irregular masses located along the top and bottom contacts of the limestone. Pure chalcopyrite and some mixed with magnetite is found along the top contact of the limestone. This forms a zone 5 to 10 feet (1.5 - 3 m.) thick that is tracable for the full length of the exposure. Magnetite with some chalcpoyrite is found along the footwall contact of the limestone. Because of slide debris and overburden, exposure of the mineralization is difficult to trace along the base of the bluff. Individual outcrops of magnetite skarn can be found but continuity cannot be established without some stripping of the cover material (MMAR, 1963, pp. 111 - 117).

The White claims were originally staked in 1916, and subsequently have lapsed and been restaked several times. Thus they have also been known as the Walton group, the Douglas group, and most recently the Foremost group. In 1955, Taiga Mines Ltd. restaked a large tract of land that included the White group and the Hetty Green group. Surface mapping and prospecting were done and a 60 foot (18 m.) adit was driven on the White showings. Later, Sunwest Minerals Ltd. thoroughly prospected part of the area from 1963 to 1974. During that time only surface reconnaisance was done on the White claims as molybdenum and nickel showings elsewhere in the area were the main thrust of exploration. There are no further reports of activity on the White claim group iron showings.

B.C. WONDER GROUP S22 MINFILE: 92F 043
TYPE: Skarn NTS: 92F 04
B Prospect LAT: 49 14' LONG: 125 38'

The B.C. Wonder claim group covers the lower reaches of Tranquille Creek at the head of the west arm of Tofino Inlet. The thirteen Crown granted claims stretch from tidewater up slope. The main workings are about 9000 feet (2745 m.) from the shore. The majority of the prospected copper - iron skarn showings are on the Iron Duke, American Wonder, and General James M. Crown Grants.

The deposit is a skarn between a limestone and a granodiorite intrusion. The contact trends approximately northwest - southeast with the intrusive to the south and the limestone to the north. Limestones are believed to be of Triassic age (MMAR, 1914, pp. K376). Associated with the limestone are small (?) layers of argillites and / or volcanics.

Garnet - epidote skarn generally follows the intrusive contact across the length of the property. Metallic minerals present are magnetite, chalcopyrite, and pyrite. Showings are lenticular to lens shaped bodies with mineralization partially mixed with skarn. Individual lenses have been exposed for 50 to 75 feet (15 - 23 m.) along strike (MMAR, 1914, pp. K376). The width of the lenses and the total length of mineralization are not known.

The B.C. Wonder group of claims were Crown Granted in 1900. At that time a small amount of surface prospecting was done. By 1903, three adits had been driven, one on each of the major showings. The property then remained idle until 1916 when more surface work was done. This was the last year for which any work was recorded on the group.

IRON MOUNTAIN, MAGNETIC S23 MINFILE: 92F 130
TYPE: Skarn NTS: 92F 03
B Prospect LAT: 49 02' LONG: 125 06'

The Iron Mountain claim lies on a small creek on the west side of Henderson Lake, 11 kilometres up stream from its discharge at Kildonan, Vancouver Island. The claim covers a series of iron skarn showings in a large bluff over a length of about 280 feet (85 m.) (MMAR, 1902, pp. H213).

Host rocks in the immediate vicinity of the showings are weathered beyond recognition. Above the showings are several small outcrops of silicified limestone, and below the showings are large outcrops of hornblende diorite (Young and Uglow, 1926, pp. 224).

Skarn is composed of garnet and epidote. Limited outcrop does not allow for a determination of the relationship between the mineralization and the host. Magnetite occurs as massive pods mixed with some skarn minerals entirely surrounded by skarn. The magnetite is free of copper minerals and pyrite. The largest outcrop is approximately 70 feet by 15 feet (21 by 4.6 m.) and several others are exposed over the length of the bluff. A sample of the magnetite yielded 50 percent iron, 0.24 percent sulphur, 22 percent silica and no phosphorous. A preliminary estimate of reserves (geologically inferred) was 20,000 tons, with no grade specified (MMAR, 1916, pp. K287).

The Iron Mountain claim was staked in 1902 and was restaked in 1916 as the Magnetic No. 1. At that time a small amount of stripping and some open cutting was done. No further activity has been reported.

JUNE S24 MINFILE: 92L 056
TYPE: Skarn NTS: 92L 06
B Prospect LAT: 50 26' LONG: 127 25'

The June claim is on June Creek on the southwest side of Anderson Lake, approximately 3 kilometres east of Port Alice. The deposit is an iron - copper skarn with the principle showings on the Anderson Lake side of the divide between it and Quatsino Sound.

Mineralization is hosted in volcanic tuff strata of the Vancouver Group. Bedding lies almost east - west and dips gently to the north. Overlying the volcanic package is Quatsino limestone that has been extensively silicified. Intruded into the volcanics and exposed to the south is a large body of granodiorite. (Young and Uglow, 1926, pp. 239 - 240)

The volcanic rocks have been pervasively epidotized and epidote - garnet skarn is best formed along the intrusive contact. Magnetite is the principle metallic mineral present. Some chalcopyrite, pyrrhotite, and pyrite are found in small quantities with the magnetite. The magnetite is commonly massive and partly mixed with skarn minerals. In some places, the mineralization appears in long, thin `stringers', often tens of feet (> 3 m.) long and about a foot (30 cm.) thick. The mineralized zone has been traced at least 400 feet (122 m.) along strike (op. cit., pp. 240).

The June claim and surrounding claims were staked about 1900. Over the next several years some surface and underground prospecting was done. (MMAR, 1903, pp. H201; 1929, pp. C378). From 1929 to 1932, the Coast Copper Co. (of the Old Sport mine) did extensive surface and underground exploration. In 1931, several `important bodies' with `appreciable values in gold and silver' were found. (MMAR, 1931, pp. A170)

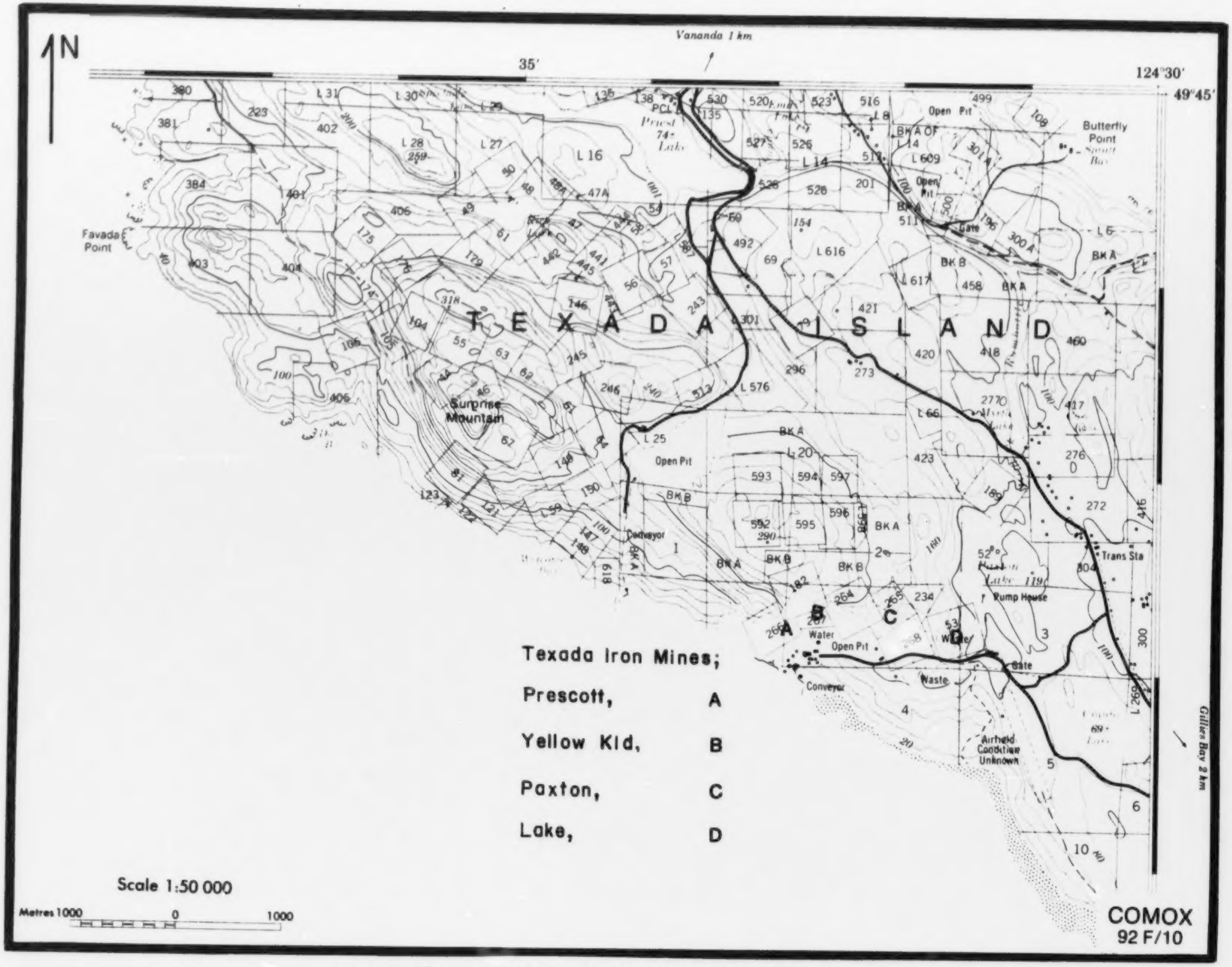

N
Vananda 1 km
35′
124°30′
49°45′
Butterfly Point
Favada Point
TEXADA ISLAND
Surprise Mountain
Open Pit
Conveyor
Water
Waste
Gate
Pump House
Trans Sta
Airfield Condition Unknown
Gillies Bay 2 km
A
B
C
D
Texada Iron Mines;
Prescott, A
Yellow Kid, B
Paxton, C
Lake, D
Scale 1:50 000
Metres 1000
0
1000
COMOX
92 F/10

Figure 25 : Location of the Texada Island iron mines

Prescott, Paxton, Lake, Yellow Kid : Texada Iron Mines Ltd. S25

TYPE: Skarn MINFIL: 92F 106,107,258,259
Past Producer NTS: 92F 10
Figure: 25, 26 LAT: 49 43' LONG: 124 34'

The Texada Island iron mines are on Gillies Bay on the west side of the island, 90 kilometres north of Vancouver.

The Texada Mines Ltd. properties consist of four separate open pits that mined magnetite skarns. The mineralogy and emplacement of the individual bodies is similar; the structural controls are markedly different. There are three major types of host rock in the deposit. These include the Texada Formation, consisting of basalts that are equivalent to the pre - Middle Carnian Karmutsen Formation of Vancouver Island, the Marble Bay Formation, consisting of limestones equivalent to the Late Triassic Quatsino Limestone, and intrusions of the differentiated Gillies stock. The stock is comprised of three modal types varying from a pyroxene granodiorite to quartz - diorite to quartz - monzonite. The early phases are generally phyrric and massive while the late stage phase tends to be mostly aplitic dykes.

The deposits can be grouped into two structural styles, the Yellow Kid and Prescott in the western pits, and the Lake and Paxton in the eastern pits. The eastern ore bodies are located in the keels of overturned synclines whose axes plunge gently to the west and whose limbs are sharply overturned to the northeast. From underground mapping it was found that the intruding stock curves out and over the rocks at depth. The lack of any other similar fold structures distal from the stock suggests that overturning of the country rocks occurred during the intrusive event. The western ore bodies are structurally more simple than those in the east. They are often referred to being like "trees", branching up and outwards from a central "stem" . The lower portion, or "stem", is within the volcanics and the stock. The upper portion, or "branches", spread up from the volcanics into the limestone. Pre - ore breccia zones are closely associated with the skarn and ore bodies. It has been suggested that the breccia offered some control to the mineralization and may be part of that event (MMAR, 1964, pp. 146 - 151).

Although the controlling structures are different, the mineralogies of the ore bodies are similar. Skarn is comprised of garnet, actinolite, pyroxene, and epidote. The ore itself is predominantly magnetite with varying amounts of copper and iron sulfides. In general, the ore bodies occur at the contact between the Gillies stock and the country rocks. A thick mantle of skarn encloses large pods of massive magnetite. Contacts between the skarn and surrounding rocks are gradational. In some places the skarn does not fully enclose the ore, in which case the magnetite sharply terminates against the limestone. Mineralization is not restricted to replacement of any specific rock type. In the Paxton deposit, skarn and ore replace the stock and the volcanics with a tongue extending along the limestone - volcanic contact. The Yellow Kid deposit represents a classic limestone replacement by skarn against an intrusion. The Prescott deposit is similar to the Yellow Kid. It shows, however, a localized `pipe' of skarn - ore within the volcanics. The `pipe' then spreads out and up into the limestone as a connected series of magnetite - skarn lenses. The Lake deposit is the exception as it has formed along the contact of the limestone and volcanics, several hundred metres for the contact of the Gillies stock.

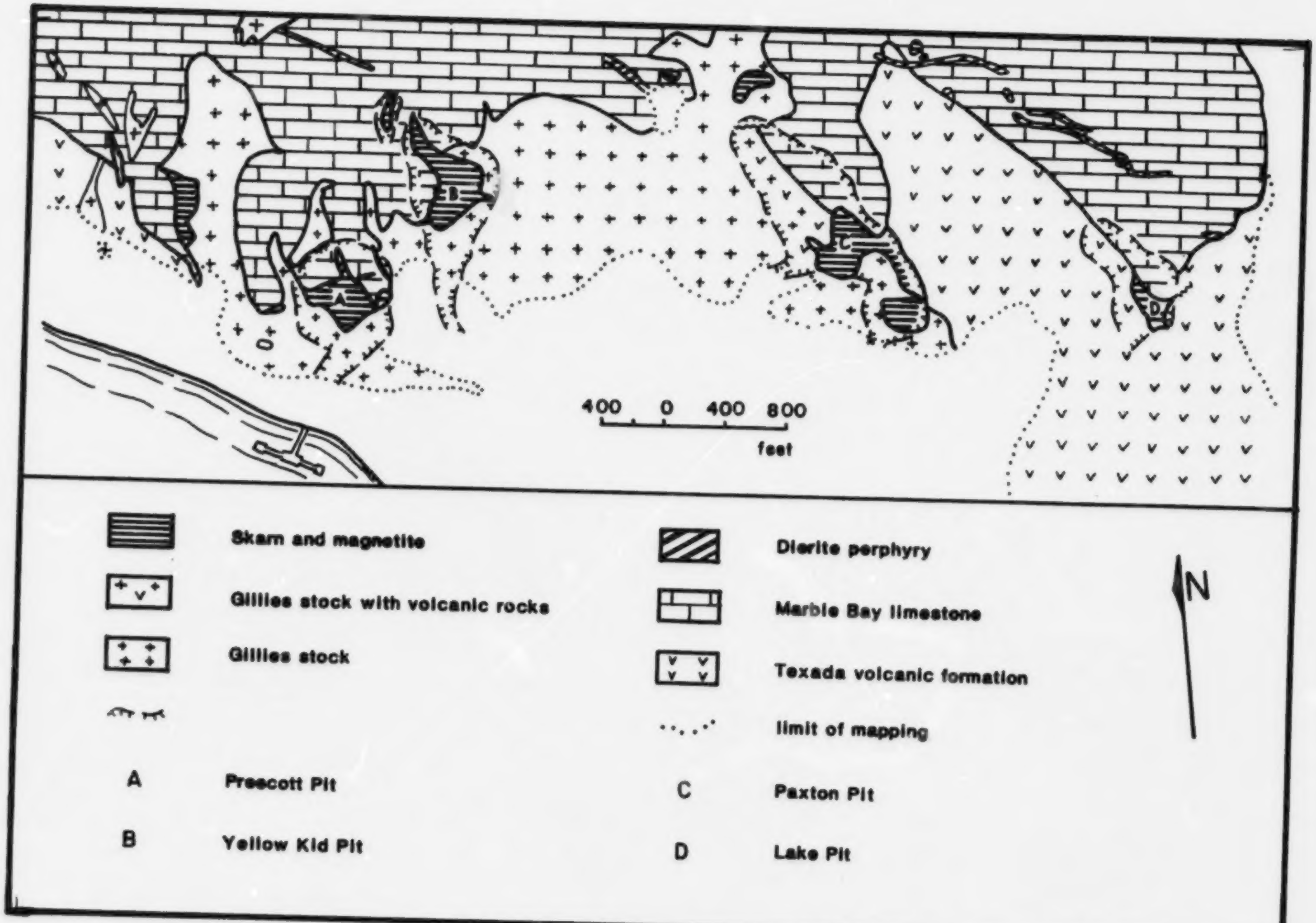

A
B
C
D
400 0 400 800
feet
Skarn and magnetite
Gillies stock with volcanic rocks
Gillies stock
A Prescott Pit
B Yellow Kid Pit
Diorite porphyry
Marble Bay limestone
Texada volcanic formation
limit of mapping
C Paxton Pit
D Lake Pit
N

Figure 26 : Sketch geology of the Texada Island iron deposit
(after EMPR Annual Report, 1964)

Sulphide mineralization is secondary within the magnetite and skarn. Sulphides are relatively abundant within the magnetite as disseminations but decreases sharply within the skarn. Where ore is in contact with limestone, there is a significant concentration of sulphides towards the limestone contact and in places a thin rind of massive sulfides occurs. The common sulphides are chalcopyrite, pyrrhotite, and pyrite, with small amounts of bornite.

The Texada Island deposits have been known for over one hundred years with the first reported shipment of magnetite ore to the United States occurring in 1885. Up until 1951, when Texada Mines Ltd., a private company, purchased outright the properties of the Puget Sound Iron Co., only minor exploration and mapping by government agencies took place.

In 1951, a large mining camp was built and construction of a mill and concentrator began. In the spring of 1952, the mill began test running and achieved full production by June of the same year (MMAR, 1952, pp. A218), of 1600 to 2000 tons per day (1,451 to 1814 tonnes per day) from the Prescott and Lake pits. Initial reserves were estimated at 700,000 tons (635,026 tonnes) of ore for the Prescott deposit, and 450,000 tons (408,231 tonnes) of ore for the Lake deposit (MMAR, 1952, pp. A220 - A221). In the following year the Paxton pit was opened for mining. Exploration and delineation of the Yellow Kid deposit began that same year. In 1955, the Yellow Kid deposit was opened for production as the Lake pit was closed. Production continued steadily for many years. Annual production during that period averaged between 350,000 to 475,000 tons (317,513 to 430,910 tonnes) of iron ore concentrate shipped and 3,000 to 4,000 tons (2,721 to 3,629 tonnes) of copper concentrate shipped. The ore graded 56.7 percent iron, 1.18 percent sulfur, and 0.18 percent copper (MMAR, 1956, pp. 129). In 1959, exploration addits were driven under the Prescott and Yellow Kid pits to determine the downward extent of the ore bodies and the mining potential. In 1964, the Prescott, North Paxton, and Lake open pits were closed. The total production from these represented 8.3 million tons (7.5 megatonnes) of ore (MMAR, 1964, pp. 147). Underground production form the Lake and Yellow Kid deposits began immediately. 1966 saw 1,315,858 tons (1.19 megatones) of ore mined, most of which came from the underground operations. 576,875 tons (523,329 tonnes) of iron concentrate and 8,248 tons (7,482) of copper concentrate were shipped that year (MMAR, 1966, pp. 72). The economic limit of minable ore was reached in 1976 and the mine was closed. The property has been purchased by Ideal Rock Products Ltd. and incorporated into their limestone and aggregate production facilities.

ELSIE	S26	MINFILE: 92K	039
TYPE: Skarn		NTS: 92K	07
A Prospect		LAT: 50 17'	LONG: 124 52'

The Elsie Crown Grant lies on the northern shore of Redonda Island, 2 kilometres west of George Point. The claim was originally staked in 1892. Although a small amount of ore was shipped, the prospect remains largely undeveloped. The deposit is in a roof pendant of sedimentary strata in a Coast Intrusive pluton.

Magnetite is hosted in skarn altered tuffs adjacent to a coarse hornblende diorite intrusion. Backing the tuffs are limestones that are completely altered to skarn. The strata strike north and dip 65 degrees to the east (MMAR, 1902, pp. 222). Skarn consists primarily of pyroxene and garnet with wollastonite and vesuvianite developed in the limestone. (Bancroft, 1913)

Magnetite is found as a large massive body 50 feet (15 m.) high and 30 feet (9 m.) wide with a 10 foot (3 m.) margin of mixed magnetite and skarn. This single exposure is the face of the old quarry. An assay yielded 60.6 percent iron, trace phosphorous and sulphur and no titanium (MMAR, 1918, pp. K282). About 50 yards (46 m.) east of the quarry, magnetite was found at surface under a thick cover of moss (Bancroft, 1913). The full extent of the deposit has not been delineated.

The Elsie claim was staked in 1892 and produced 626 tons (568 tonnes) of high quality ore. Since then no further development of the property has taken place.

BLACK WARRIOR S 27 MINFILE: 92K 040
TYPE: Skarn NTS: 92K 07
A Prospect LAT: 50 17' LONG: 124 52'

The Black Warrior claim group adjoins the east side of the Elsie Crown Grant. The deposit present appears to be the continuation of the same mineralized roof pendant and may represent a potentially large zone of mineralization.

Host rocks are recrystallized limestone and an altered greenstone. Skarn mineralization follows the contact of the limestone and diorite intrusive. It is not clear if the greenstone is between the limestone and diorite. Magnetite is hosted within skarn and occurs as massive lenses. There are two major showings in the group. The first is on the Black Warrior where a face of massive magnetite 14 feet (4 m.) wide and 50 feet (15 m.) high is exposed. A chip sample yielded 64.8 percent iron, trace phosphorous and sulphur and no titanium (MMAR, 1918, pp. K283). A short adit that was driven into the face did not find the back of the zone. The second outcrop is on the Homestake claim where a zone measuring 60 feet (18 m.) across is reported. (ibid.)

The Black Warrior claim group has had a small amount of work done just proir to and during 1919. There are no other reports of activity on the claims.

COPPER GROUP S28 MINFILE: 92G NW 017
TYPE: Skarn NTS: 92G 13
B Prospect LAT: 49 49' LONG: 123 51'

The Copper claims lie on Treat Creek on the southern slopes of Treasure Mountain . This is on the east side of Jervis Inlet, at Prince of Wales Reach. The deposit is a skarn in a roof pendant of strata trapped within Coast Intrusives.

Host strata are a series of andesitic volcanic tuffs with included layers of argillite, chert, limestone, and basalt flows. The whole package has been extensively altered by a quartz diorite phase of the Coast Plutonic Complex. Skarn mineralization occurs along a parallel series of east - west trending structures. Garnet and epidote are the major skarn minerals. Contained within the skarn are lenticular, massive bodies of pyrrhotite, and magnetite. The width and length of mineralization are not specified. A series of five adits over a vertical elevation of 210 feet (64 m.) have been driven to explore the mineralization (MMAR, 1922, pp. N250).

The Copper group of claims were staked prior to 1917. During the period of 1917 to 1922, a large amount of surface stripping, open cutting and adit driving was done to develop the showings. The property then remained idle until 1972 and 1973 when some surface mapping and diamond drilling was done by the El Paso Mining and Milling Co.. The results of that work are not published and there are no further reports of activiy on the claims.

COPPER KING, THEODOSIA S29 MINFILE: 92K 053
TYPE: Skarn NTS: 92K 02
B Prospect LAT: 50 07' LONG: 124 35'

The Copper King Crown granted claim and associated claims lie approximately 6 kilometres up the Theodosia River from its mouth at the head of Theodosia Inlet near Desolation Sound. The deposit is a polymetallic skarn, primarily copper and iron.

The skarn follows a northwest trending contact of greenstone and limestone across the southern slope of a ridge. There is extensive epidote skarn alteration of the greenstone unit. Metallic minerals present are magnetite and chalcopyrite with galena and sphalerite present locally. The areal extent of the mineralization is not known. Work done in the early part of the century exposed a zone at least 64 feet long and 52 feet wide (19.5 by 16 m.). As well, a Glory Hole at the end of the long open cut exposes mineralization 30 feet by 12 feet (9 by 3.7 m.) at surface and 10 feet (3 m.) deep. (MMAR, 1926, pp. 310) A best assay of the magnetite ore yielded 55.6 percent iron, no copper and trace silver and gold (ibid.).

The Copper King claim and four others were located about 1898 and were Crown Granted soon after. In 1926, surface prospecting was done as well as examination of the previous workings and adit. In 1959, a road from the head of Theodosia Inlet was put in by Norco Resources Ltd. and over the next several years further prospecting and some diamond drilling were done. The results of this work are not published and there are no reports of activity since 1966.

KITCHENER, HAIG S30 MINFILE: 92M 001
TYPE: Skarn NTS: 92M 02
B Prospect LAT: 51 07' LONG: 126 44'

The Kitchener / Haig claims cover the hill slope at the head of Wigwam Bay. This is a small bay on the north shore of Seymour Inlet, about 11 kilometres from the head of the inlet. The deposit is a skarn in a metamorphosed roof pendant.

The roof pendant is a section of highly metamorphosed volcanic rocks and sediments that include limestone layers. A schistosity is well developed and parallels the northwest trend of the strata. Also, the strata are locally contorted with the whole package sitting on edge. The width of the pendant is approximately 2000 feet (610 m.) and its length extends beyond the limit of the claims. The surrounding intrusive body is granitic and contains partially stoped blocks of the pendant. (Young and Uglow, 1926, pp. 55 - 58)

Magnetite occurs as massive pods, lenses and disseminations in the host strata. Individual bodies, where exposed, vary from one or two square feet (< 1 square metre) to 50 through 75 square feet (4.5 to 7 square metres) (op. cit., pp. 58). Drift cover is extensive and only the small pods are fully exposed. Magnetite is generally free of rock fragments and sulphides. An assay of the massive iron ore yielded 65.5 percent iron, 0.5 percent sulphur, and 4.6 percent insolubles (MMAR, 1917, pp. F65). A total of 14 individual showings are reported by Young and Uglow (1926).

The Kitchener / Haig claims were staked prior to 1917. A small amount of prospecting work did not reveal much of the showings but the high quality of the iron ore was impressive (MMAR, 1917, pp. F65). Further work was reccommended but there are no other reports of any activity.

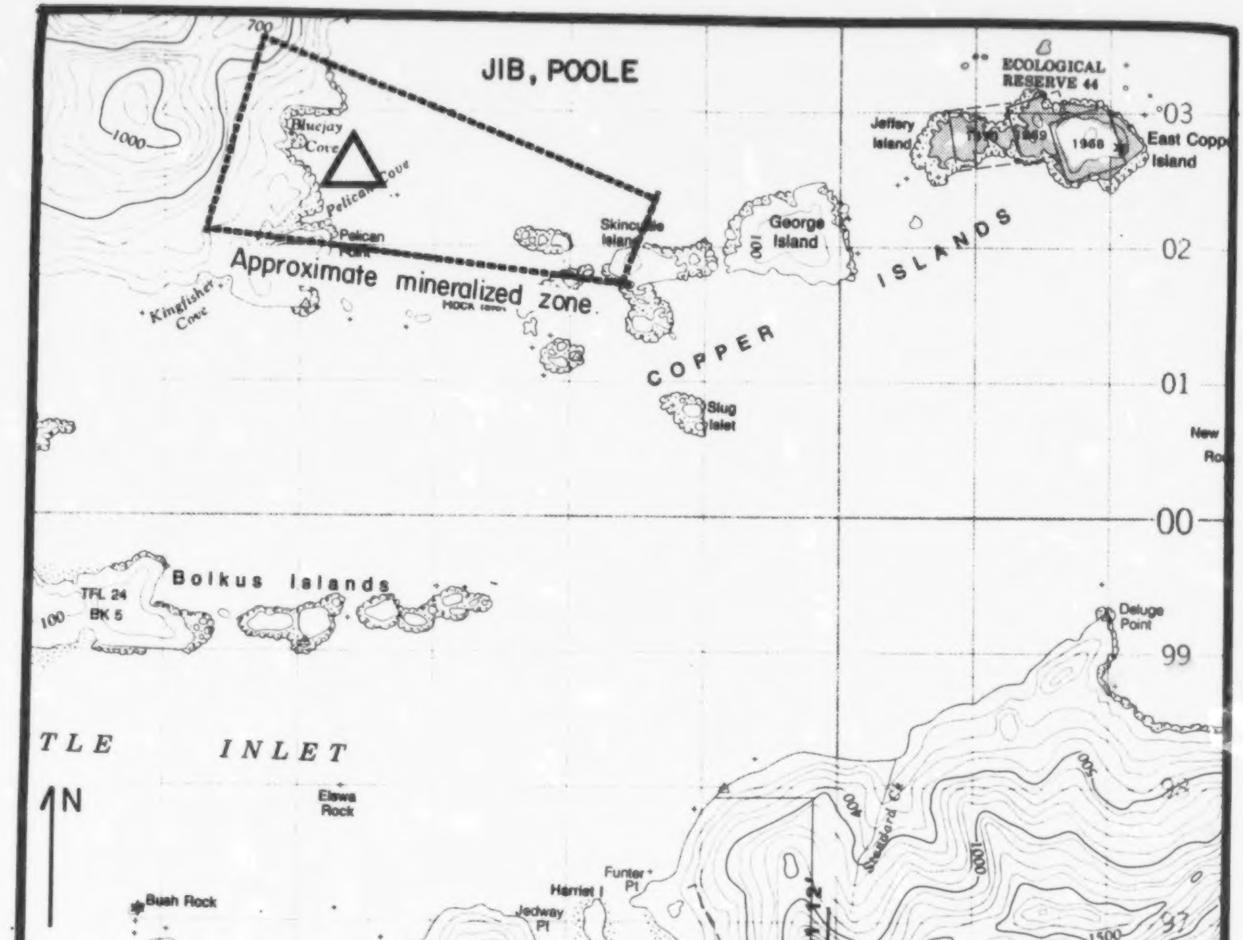

JIB, POOLE
Approximate mineralized zone.
Bluejay Cove
Pelican Cove
Pelican Point
Kingfisher Cove
Skincuttle Island
George Island
COPPER ISLANDS
ECOLOGICAL RESERVE 44
Jeffery Island
East Copper Island
Slug Islet
Bolkus Islands
TFL 24 BK 5
INLET
N
Elswa Rock
Bush Rock
Green Rock
Kankidas Point
Jedway Bay
Jedway Pt
Harriet I
Funter Pt
Harriet Harbour
Deluge Point
52 18'
131 12'
ADONIS
JEDWAY IRON, JESSIE
LILY
MORESBY
TREE FARM LICENCE 24 BLOCK 5
Metres 1000 0 1000
BURNABY ISLAND
103 B/6
03
02
01
00
99
98
97
96
95
1000
1500
1400
700

Figure 27 : Location of the Jedway iron claims and the Jib deposit

JESSIE, ADONIS S31 MINFIL: 103B 026
TYPE: Skarn NTS: 103B 06
Past Producer LAT: 52 17' LONG: 131 11'
Figure: 27, 28

The Jessie mine was the first major mine on the Queen Charlotte Islands and it was the first in the area to examine the geology below surface. The Jessie deposit is adjacent to the northeast flank of the Jedway stock and is near the contact between Karmutsen volcanics and the overlying Kunga Formation. Structures in the area are relatively simple and do not distort the ore body very much.

The Jedway stock, part of the Coast Intrusive sequence, is a hornblende diorite of late Cretaceous or early Tertiary age. It is exposed on surface over an area of 1 1/2 square miles (3.8 km.^{2}). The stock encloses the eastern shore of Harriet harbour and extends south for several hundred metres. It is responsible for the many magnetite showings in the area.

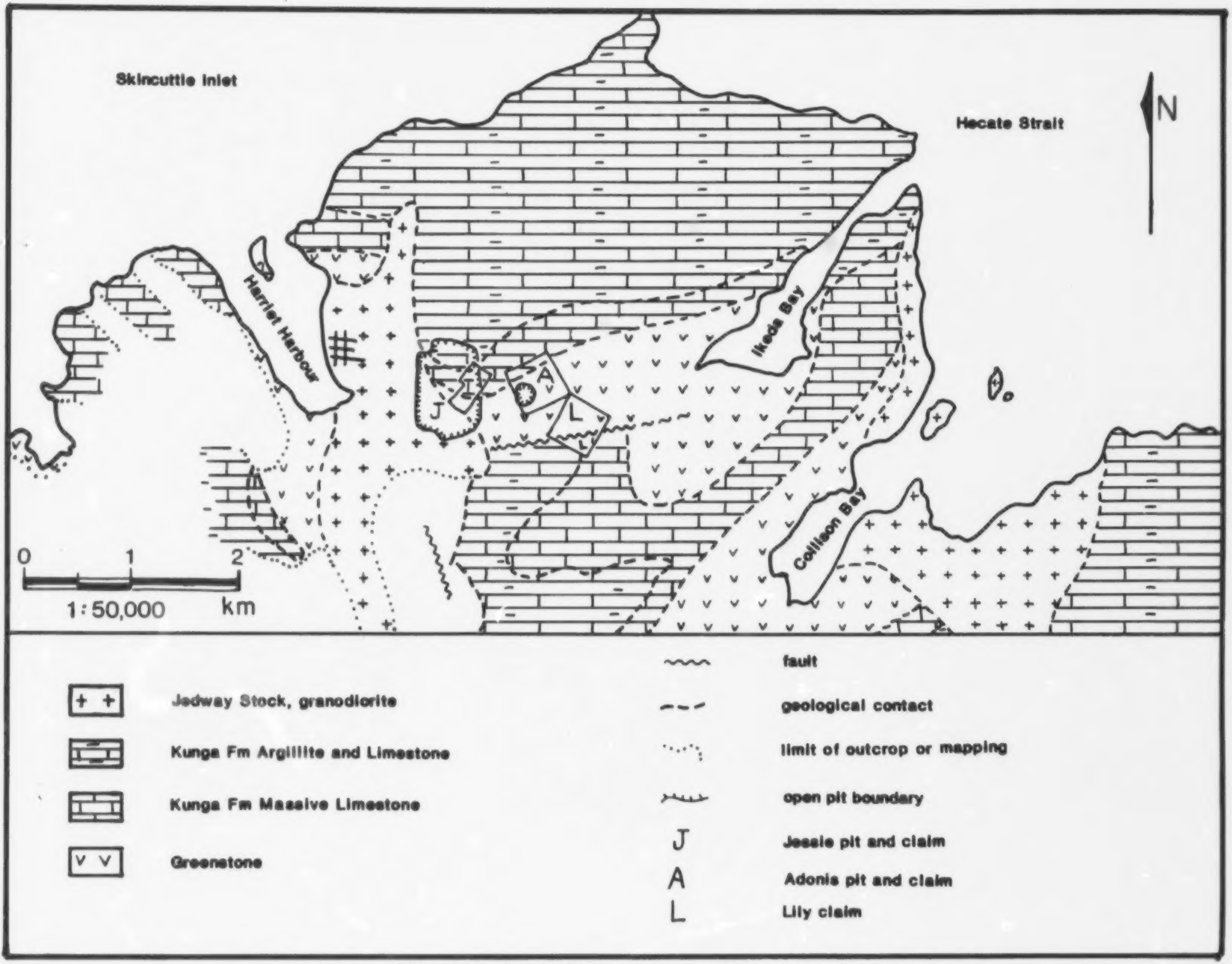
The Jessie mine is hosted within the topmost part of the Karmutsen volcanics. This volcanic package comprises a sequence of pervasively chloritized massive greenstone similar to that on Vancouver Island. Bedding and flow features are almost completely obliterated by alteration caused by the intrusion of the Jedway stock.

Fifty to one hundred feet (15 to 31 m.) of limestones and argillites of the Kunga Formation (Karnian to Sinemurian) overly the Karmutsen volcanics. (MMAR, 1961, pp. 13 - 15) Above the limestones are interbedded silicic and calcareous argillites.

Host rocks have been folded into an east - west domed anticline. Doming was caused by a later broad fold oriented northwest - southeast. The deposit is in the northern limb of the anticline. Bedding dips steeply north, varying from 45 to 70 degrees. Folds have been cut by a series of faults of which there are two major sets. The first strike northerly and dip steeply to the east; the second, strike northeast and dip steeply south. The northerly trending faults crosscut and offset the easterly trending faults. With the exception of four major faults, two of each orientation, displacements are small. These faults cut through the pit, although they do not offset the ore body, they significantly displace the host rock. The greatest displacement is 400 feet (122 m.) oblique to the dip (A.S. Brown, 1968, pp. 198 - 203). To the east of the Jessie ore body, a second smaller ore zone, the Adonis, is exposed at surface due to down faulting on a northeast striking fault.

Skarn, which is not extensive on the property, consists of a mineral assemblage of garnet and epidote with some actinolite. The skarn predates ore mineralization and is largely replaced by magnetite. Skarn remains as a thin envelope around the magnetite and is mixed within the magnetite.

Mineralization is primarily massive to dense magnetite with rare pods or disseminations of chalcopyrite. Magnetite occurs as large layers, about 50 feet (15 m.) thick, subparallel to bedding and is continuous over 800 feet (244 m.) along strike and a similar distance down dip. At about 500 feet (1525 m.) below the surface, a southwest shallowly dipping normal


Skincuttie Inlet
Hecate Strait
N
Harriet Harbour
Ikeda Bay
Collison Bay
J
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A
L
0
1
2
1:50,000
km
Jedway Stock, granodiorite
Kunga Fm Argillite and Limestone
Kunga Fm Massive Limestone
Greenstone
fault
geological contact
limit of outcrop or mapping
open pit boundary
J Jessie pit and claim
A Adonis pit and claim
L Lily claim

Figure 28 : Sketch geology of the Jedway iron deposit
(after Falconbridge Nickel Mines Ltd., 1964)

fault offsets the deposit about 100 feet (31 m.). During development of the mine, ore assayed: 49 percent iron; 0.025 percent copper; 0.78 percent sulphur; 0.09 percent titanium; 0.035 percent phosphorous (MMAR, 1959, pp. 14). During production the concentrate averaged 62 percent iron (Sutherland Brown, 1968, pp. 199).

The major ore body was the Jessie but a smaller body, the Adonis, 1000 feet (305 m.) to the east, provided additional ore for the Jedway Iron Ore Ltd. operation. The ore zone at the Adonis was a fault bounded block with similar mineralization to the Jessie zone. It is also located at the top of the Karmutsen volcanics, completely contained within the unit. A third ore body on the Rose claim three miles to the east of the Jessie, similar to the Jessie zone, also provided magnetite during the last two years of mine production.

The earliest exploration in the area was by F. Poole, in 1863, who was looking of copper mineralization. In 1956, Silver Standard Mines Ltd. optioned several claims around the Jessie showings and by 1960 the company had drill proven 2.5 million tons (2.27 megatonnes) of magnetite ore (MMAR, 1960). The Granby Mining Company optioned the property then later purchased it in 1961. The total ore reserves drill indicated in 1961 were 4.7 million tons (4.26 megatonnes) (MMAR, 1961, pp. 15). The mine operated continuously from 1962 to 1968 when the ore was mined out. The mine used both open pit and underground methods simultaneously to mine the Jessie zone. The Adonis and Rose bodies were mined by conventional open pit methods. For the period of production, 19 million tons (17.2 mega tonnes) of ore and waste were mined. From that, 4.3 million tons (3.9 megatonnes) of ore were treated and 2.3 million tons (2.1 megatonnes) of concentrate were shipped (MMAR, 1968, pp. 71). The mine was closed, dismantled and allowed to deteriorate. Little work has been done since on the property and the results have not been made public.

LILY S32 MINFIL: 103B 028
TYPE: Skarn NTS: 103B 06
Past Producer LAT: 52 17' LONG: 131 11'
Figure: 27

The Lily copper mine is situated several kilometers to the east of the Jessie mine, near the head of Ikeda Cove. The claim was mined for high grade copper in the early 1900's.

The Lily deposit is contained in the uppermost part of the Karmutsen volcanics. There are several lenses of limestone in the volcanics but they are believed to be an interbedded unit of the Karmutsen. The rocks strike northeast and dip moderately to the southeast. In the northwest part of the property, Kunga limestones are exposed but do not contain any mineralization.

Chalcopyrite and magnetite mineralization is contained within three shear zones which strike north - northeast, dip steeply eastward and vary from 2 to 25 feet (0.61 to 7.6 m.) wide. The main shear averages 25 feet (7.6 m.) wide and has moderate grade ore. The smallest shear averages 2 feet (0.61 m.) wide and carries the high grade ore. Strike length of the zones is about 700 feet (213 m.). The two main ore shoots are 250 and 140 feet (76 and 42 m.) long and were mined for about 100 feet (31 m.) down dip. The narrow high grade shoot was stoped for over 140 feet (42 m.). (Sutherland Brown, 1968, pp. 203 - 207)

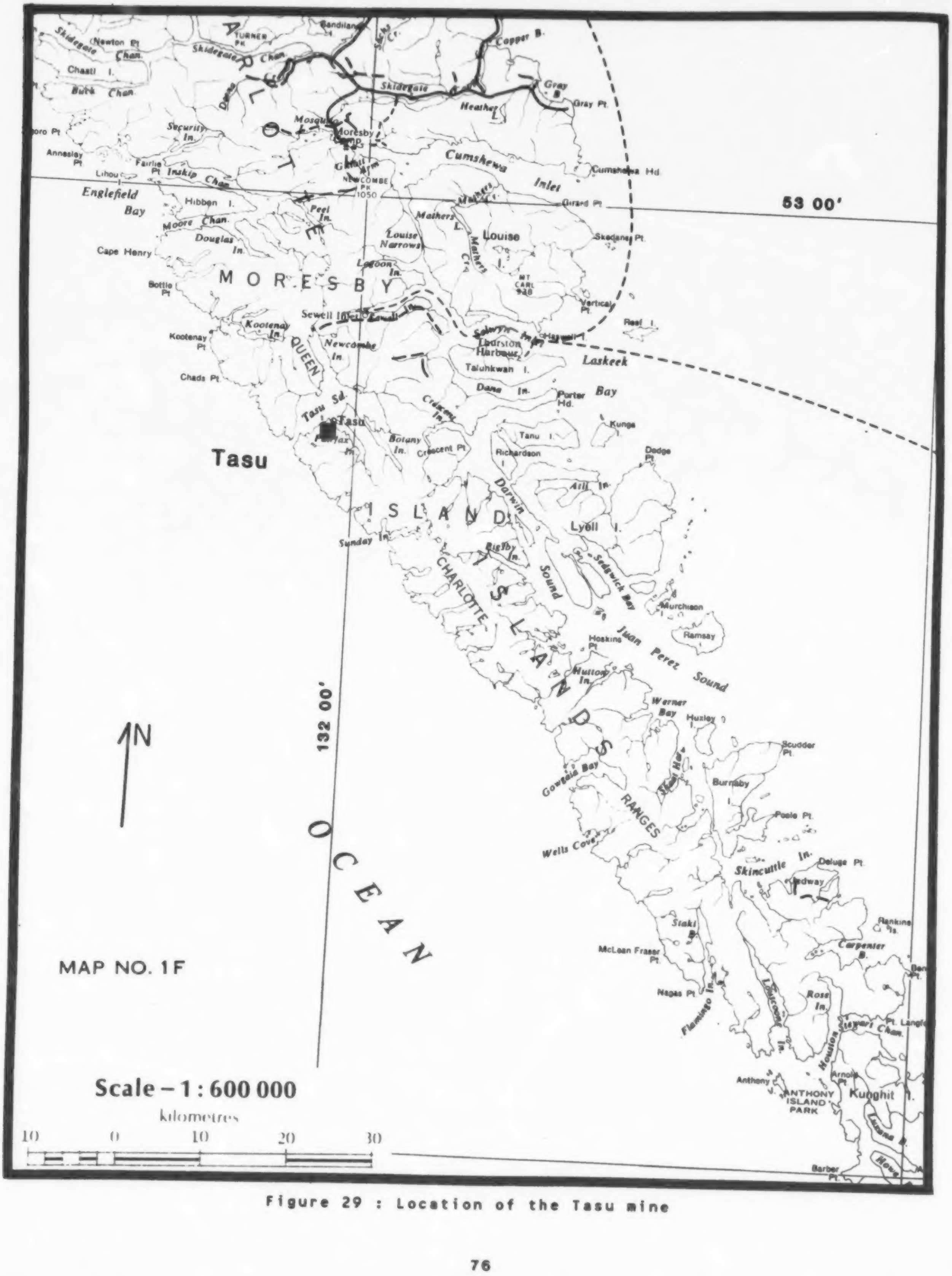
53 00'
132 00'
MORESBY
ISLAND
QUEEN
CHARLOTTE
ISLANDS
RANGES
OCEAN
Tasu
Tasu Sd.
Fairfax In.
N
MAP NO. 1F
Scale – 1 : 600 000
kilometres
10
0
10
20
30
Skidegate Chan.
Newton Pt
Chaatl I.
Buck Chan.
Security In.
Annesley Pt
Lihou I.
Fairlie Pt
Inskip Chan.
Englefield Bay
Hibben I.
Moore Chan.
Douglas In.
Cape Henry
Bottle Pt
Kootenay In.
Kootenay Pt
Chads Pt
Peel In.
Louise Narrows
Logan In.
Sewell Inlet
Newcombe In.
Botany In.
Crescent Pt
Sunday In.
Mosquito L.
Moresby Camp
Gillatt Arm
NEWCOMBE PK 1050
Sandilands
TURNER PK
Copper B.
Skidegate L.
Gray B.
Gray Pt.
Heather L.
Cumshewa Inlet
Cumshewa Hd.
Girard Pt.
Mathers L.
Mathers Cr.
Louise I.
MT CARL 938
Skedans Pt.
Vertical Pt.
Reef I.
Selwyn In.
Thurston Harbour
Talunkwan I.
Dana In.
Laskeek Bay
Porter Hd.
Kunga
Tanu I.
Richardson I.
Dodge Pt.
Atli In.
Darwin Sound
Lyell I.
Bigsby In.
Sedgwick Bay
Murchison
Ramsay
Juan Perez Sound
Hoskins Pt.
Hutton In.
Werner Bay
Huxley I.
Scudder Pt.
Burnaby I.
Gowgaia Bay
Poole Pt.
Wells Cove
Skincuttle In.
Deluge Pt.
Jedway
Rankine Is.
Carpenter B.
Staki B.
McLean Fraser Pt.
Nagas Pt.
Flamingo In.
Louscoone In.
Ross In.
Stewart Chan.
Houston
Arnold Pt.
Anthony I.
ANTHONY ISLAND PARK
Kunghit I.
Barber Pt.

Figure 29 : Location of the Tasu mine

The Lily deposit is not a classic copper skarn. Mineralization consists of magnetite, chalcopyrite, pyrrhotite, actinolite, and chlorite. Garnet is conspicuous by its absence. Small amounts of gold and silver are associated with the sulphides (MMAR, 1918, pp. K39). Mineralization occurs as a nearly complete replacement of host rock within the shears. Sulphide mineralization consists of disseminations, thin lenses and sporadic blebs.

The Lily deposit was discovered by Japanese fishermen who found chalcopyrite float on the beaches of Ikeda Cove. The first shipments of high grade, hand picked ore began in 1906 and continued,with some breaks, to 1920. When the high grade copper ore gave out the mine was closed. Production for the mine was 14,780 tons of waste and ore mined (Sutherland Brown, 1968). The magnetite portion of the ore was left as waste. In 1956 the property was sampled in detail and then drilled in 1964. There has been no further activity at the site.

TASU , TASSOO S33 MINFIL: 103C 002
TYPE: Skarn NTS: 103C 09 / 16
Past Producer LAT: 52 45' LONG: 132 03'
Figure: 29, 30

The Tasu mine, situated on the west coast of Morseby Island in Tasu Sound, was the last major producer of magnetite concentrate in British Columbia. The mine had produced magnetite concentrate over an aggregate of 20 years when it closed in 1984. Concentrate was primarily shipped to Japan as iron ore. The deposit was a huge massive magnetite skarn with an annual production of nearly one million tons (0.9 megatonnes) of ore.

The Tasu deposit is contained in the topmost part of the Karmutsen volcanics. These volcanics have been substantially metamorphosed to greenstone and pervasivly chloritized. Bedding and flow features have been lost to the effects of metamorphism. Overlying the volcanics are 500 feet (153 m.) of limestones of the Kunga Formation. Above the limestones are the upper Kunga Formation argillites. Limestones have been completely recrystallized and bedding features are absent; and argillites are completely hornfelsed, often difficult to distinguish from greenstone.

The stratified succession is intruded to the south by the northern end of the San Cristoval batholith. The batholith, which is a foliated hornblende diorite, is exposed at surface south of the deposit and extends north under the deposit. Within the deposit itself is a laccolith - like intrusion of feldspar - hornblende porphyry. The relative age of the two intrusions are difficult to distinguish, but it appears the porphyry is older. All the rock types have been skarn altered and mineralized with magnetite to some extent. Post - dating mineralization are two types of dykes. Earlier dykes are plagioclase porphyrytic andesites while the later dykes are basaltic to gabbroic in composition and are aphanitic. Only the last set of dykes are undeformed by folds and faults.

The deposit occurs in the eastern limb of a moderate northwest plunging syncline. Each limb of the anticline is terminated by a small anticline. Primary mineralization extends just into the crest of the eastern anticline. The San Cristoval batholith was emplaced during the tectonic event which folded the stratified rocks. As a result the batholith has a pronounced foliation. A substantial amount of faulting has cut the deposit but none of the displacements are large. Two ages of faulting are known. Some faults are pre - ore and have post - ore movement while other faults are solely post - ore. The faults all strike northwesterly. Two faults in specific control ore deposition.They are approximately prependicular and strike northerly and easterly with steep

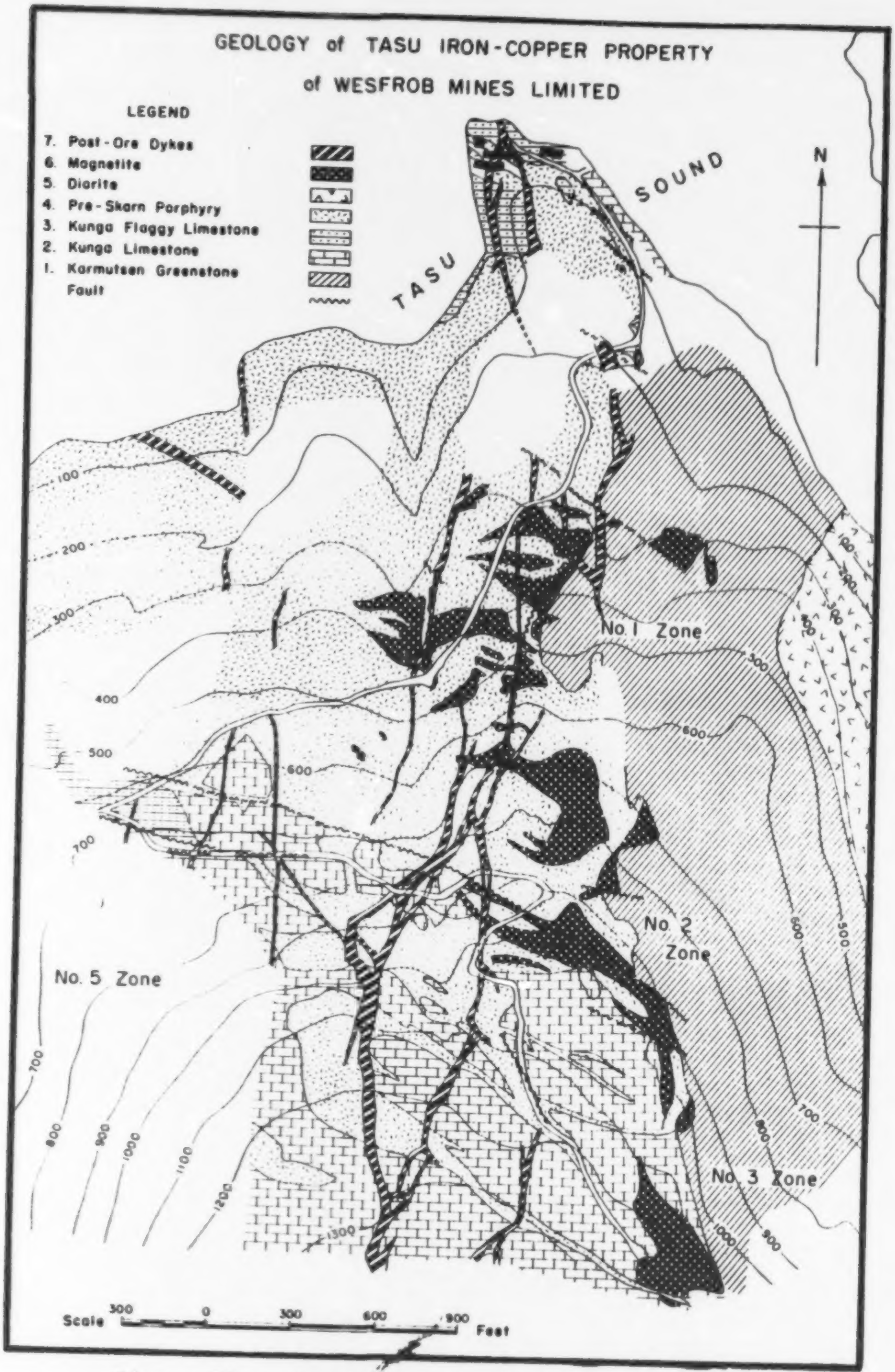
GEOLOGY of TASU IRON-COPPER PROPERTY
of WESFROB MINES LIMITED
LEGEND
7. Post-Ore Dykes
6. Magnetite
5. Diorite
4. Pre-Skarn Porphyry
3. Kunga Flaggy Limestone
2. Kunga Limestone
1. Karmutsen Greenstone
Fault
N
TASU
SOUND
No. 1 Zone
No. 2 Zone
No. 3 Zone
No. 5 Zone
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Scale 300 0 300 600 900 Feet

Figure 30 : Sketch geology of the Tasu deposit
(after EMPR Annual Report, 1963)

dips. The maximum vertical offset is about 200 feet (61 m.). (Sutherland Brown, 1968)

Skarn mineralization is wide spread throughout the deposit. Limestone is least affected as skarning is limited to lenses and pods within the unit. Volcanics are substantially altered to skarn with the most complete alteration near the ore bodies. The porphyry is often completely altered to skarn while the diorite contains little or no mineralization.

The ore zone consists of a series of four major subparallel planar bodies. These bodies vary in thickness from 50 to 200 or more feet (15 to > 61 m.) and can be traced along strike for up to 300 feet (92 m.). The total strike length of the deposit is nearly 4,000 feet (1220 m.) and it extends through most of the greenstone (MMAR, 1963, pp. 13 - 16). The ore zones roughly follow the bedding of the volcanic unit. Locally they are influenced by the porphyry or limestone contacts and bend to follow those contacts. Near pre - ore faults there is a marked thickening of ore and improvement of grade. As well as the four major zones, mineralization branches and spreads through the volcanics. Magnetite is generally massive throughout the deposit. Throughout the mine, skarn was closely associated with the magnetite, often becoming quite mixed with ore.

Some sulphide mineralization, primarily chalcopyrite, occurs within the magnetite. It is most prominent where the magnetite is thickest. Low values of gold have been associated to the chalcopyrite but no significant quantity was produced. Magnetite is by far the most important mineral at the mine.

The Tasoo magnetite showings were first staked in 1908. From 1914 to 1917, a small mining operation shipped 5,180 tons (4,699 tonnes) of copper ore (MMAR, 1956, pp. 127). Interest in the property as a source of iron ore was rekindled and systematic development of the property was initiated by Wesfrob Mines Ltd. in 1956. Exploration continued , with one short break, through 1964. When 43.2 million tons of ore reserves had been proven the mine was officially opened in 1967 and initial production was from an open pit (Sutherland Brown, pp. 183). The open pit was worked for ten years until the physical limit of mining had been reached and underground production began. The mine continued to produce magnetite until 1984. When the open pit was closed in 1977, the copper treatment circuit was discontinued. The sole products then were iron ore concentrate sinter feed and pellet feed. Total production for the mine was approximately 20 million tons (18 megatonnes) of iron ore. Since the close of the mine the property and townsite have been abandoned. Little further work has been done on the property.

IRON DUKE S34 MINFILE: 103B 001
TYPE: Skarn NTS: 103B 13
A Prospect LAT: 52 59' LONG: 131 44'
Figure: 31

The Iron Duke claim group is located on the north side of Louise Island near Waste Creek, 27 kilometres south southeast of Sandspit. The deposit is an iron skarn with considerable potential for magnetite production. A large amount of proven reserves remain undeveloped on the property.

Skarn is hosted in Triassic Kunga Formation limestones and altered Karmutsen volcanics (Sutherland Brown, 1968). The limestone appears as three northwest - southeast noses, open to the northwest and closed to the southeast. These are probably the keels of several recumbent synclines. The underlying volcanics are fine grained hornblende - feldspar porphyrytic greenstones. Intruding the succession is a large pluton of

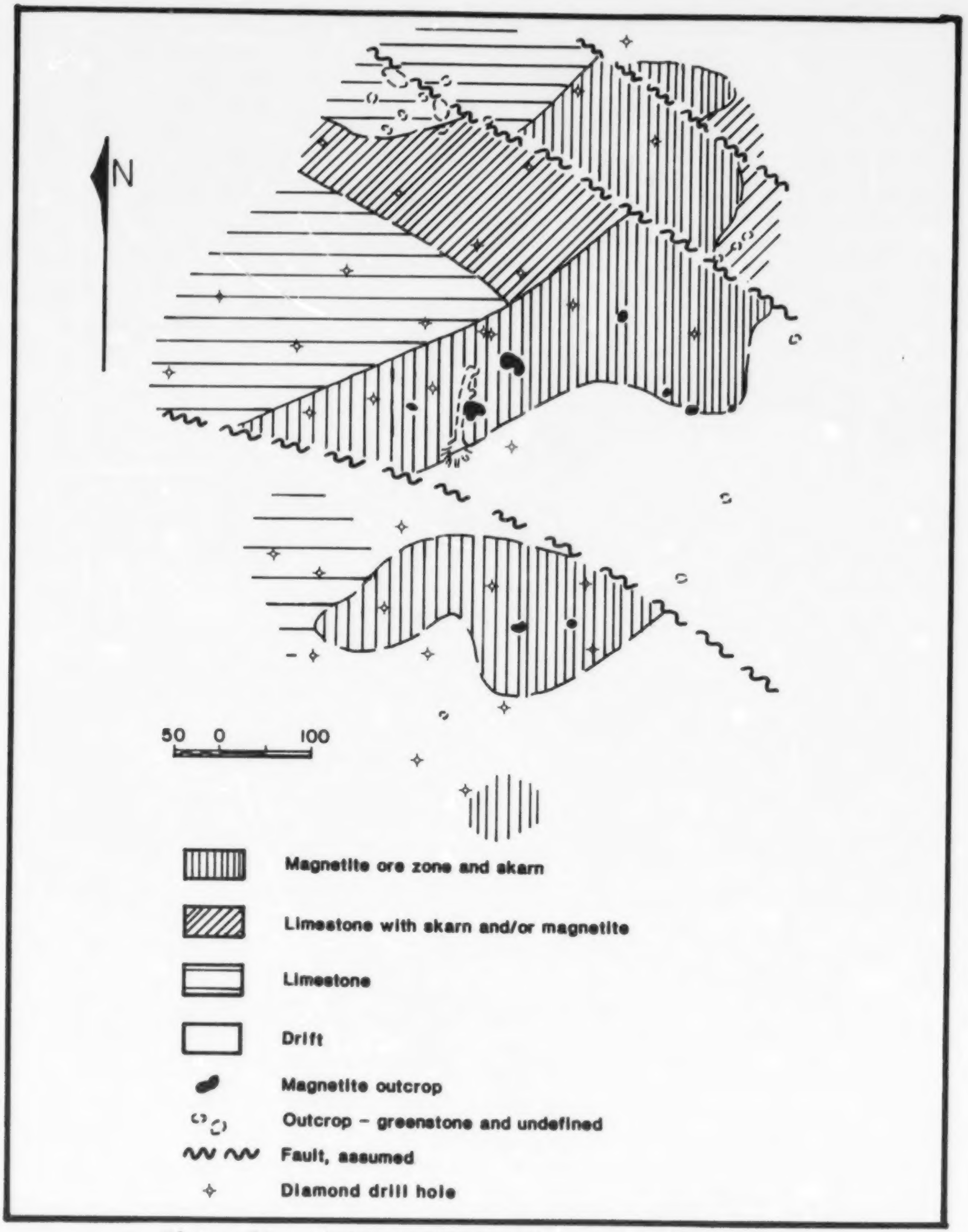
N
50
0
100
Magnetite ore zone and skarn
Limestone with skarn and/or magnetite
Limestone
Drift
Magnetite outcrop
Outcrop – greenstone and undefined
Fault, assumed
Diamond drill hole

Figure 31 : Sketch geology of the Iron Duke deposit (after Sutherland Brown, 1968 and Silver Standard Mines Ltd.)

quartz diorite. Later intrusions of pyritic, fine grained dacite dykes cut the host rocks (Campbell, 1962).

Skarn alteration is of two types, dependant on the host lithologies. The limestone is partially altered to a garnet skarn which is confined to the formational base. Skarn is massive to medium crystalline, olive green - brown and is locally magnetite and pyrite rich. Volcanic rocks are almost completely altered to epidote skarn. The bulk of the magnetite mineralization is within the epidote skarn and follows the limestone - greenstone contact. Three post ore faults transect the property. They are oriented northwest - southeast, with vertical dips and displacements vary from 50 to 300 feet (15 to 91 m.).

The area of mineralization extends approximately 960 feet (293 m.) northeast and is 200 or more feet (+ 61 m.) wide (Sutherland Brown, 1968). Magnetite is generally massive and quite pure. Locally there are small inclusions of magnetite mixed with pyrite and skarn minerals. Mineralization is surrounded by a rind of skarn. Chalcopyrite is rare and is noted in only a few places.

There are seven significant mineralized zones of which four are large. These bodies lie below and adjacent to the southeast ends of the limestone `noses'. Although the zones appear as discrete entities they could be part of a connected system. (Campbell, 1962) The bodies have been described as follows:

A Upper - at surface; 40 to 60 feet thick by 300 square feet (12 - 18 m. by 28 m. square).

B Upper - 10 to 20 feet (3 to 6 m.) below A Upper, skarn between, 20 feet (6 m.) thick, 60 to 140 feet (18 to 43 m.) wide, 320 feet (98 m.) or more long into the hillside.

B / A Lower - 40 feet (12 m.) below B Upper, skarn between, 80 to 180 (24 to 55 m.) wide, 400 feet (122 m.) long into the hillside, possibly connected to B Upper to the east.

B2 - under the middle limestone nose, skewed rectangular shape, 80 feet (24 m.) maximum thickness, 180 feet (55 m.) wide, 300 feet (92 m.) long east - west, eastern boundary is in skarn at the greenstone contact.

(after Campbell, 1962).

Several smaller magnetite pods lie immediately to the south of the major bodies. Reserve figures for the Iron Duke deposit are:

Proven reserves	546,455 tons at 46 percent Fe_3O_4 (495,733 tonnes)
Possable reserves	36,135 tons at 47 percent Fe_3O_4 (32,780 tonnes)

average sulphur content is 2 percent.(after Campbell, 1962)

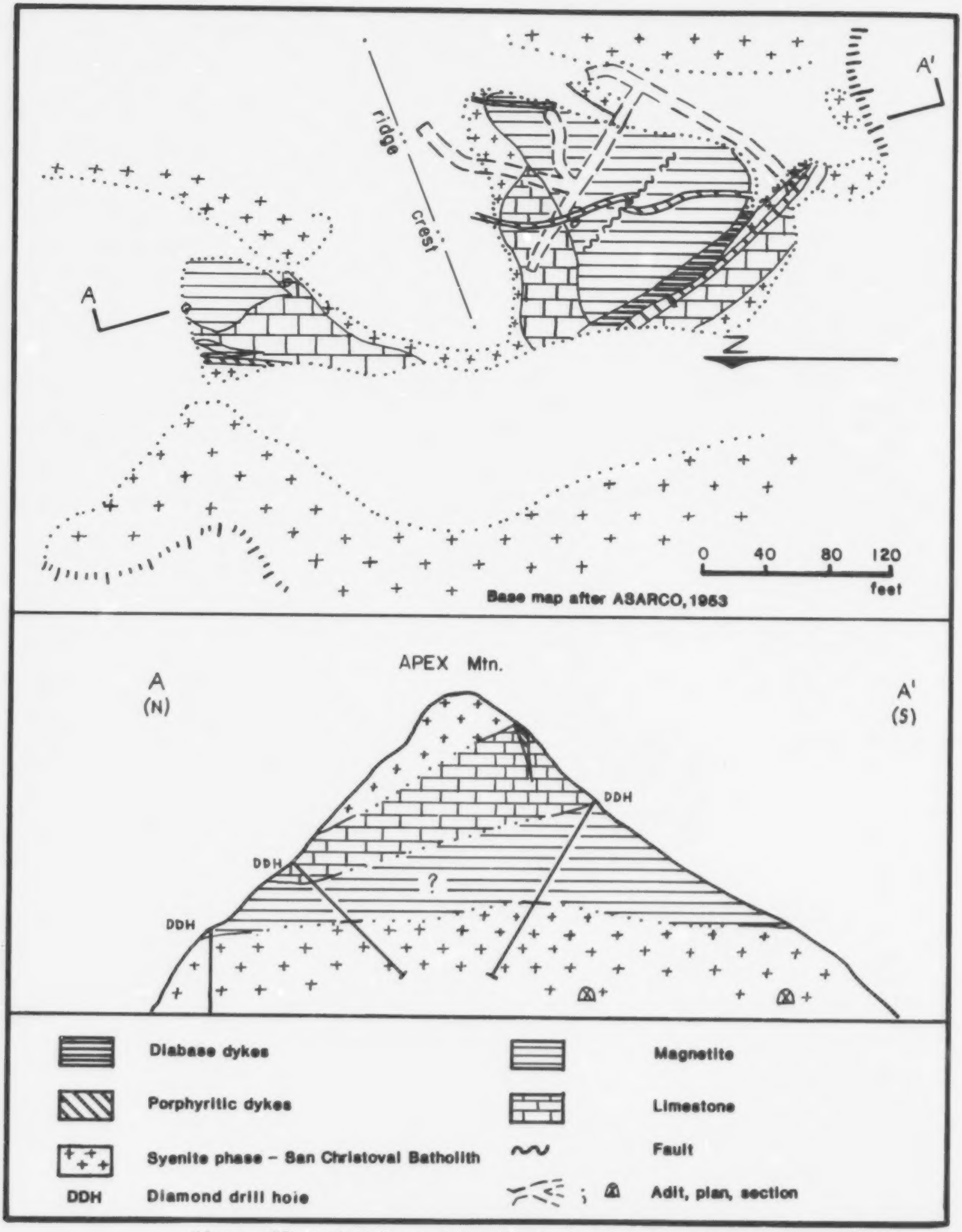
A
A'
ridge crest
N
0 40 80 120
feet
Base map after ASARCO, 1953
APEX Mtn.
A
(N)
A'
(S)
DDH
DDH
DDH
?
Diabase dykes
Porphyritic dykes
Syenite phase – San Christoval Batholith
DDH Diamond drill hole
Magnetite
Limestone
Fault
Adit, plan, section

Figure 32 : Sketch geology of the Apex, Star deposit (after ASARCO Ltd., 1953)

The Iron Duke claims were initially staked prior to 1911. Some surface prospecting was done about that time and by 1918 an adit had been driven 69 feet (21 m.) into the largest showing (Sutherland Brown, 1968). The next reported activity, between 1960 and 1962 includes surface and drill work by Silver Standard Mines Ltd. and Canax Ltd.. Subsequent to 1962, there are no further reports of activity.

APEX, STAR S35
TYPE: Skarn
A Prospect
Figure: 32

MINFILE: 103B 008
NTS: 103B 12
LAT: 52 42' LONG: 131 54'

The Apex claims cover the summit and upper slopes of Apex mountain between Tasu and the old village of Lockeport. The Apex deposit is an iron skarn in a roof pendant of limestone. Prospecting and diamond drilling have delineated a sizable body of magnetite. No production has taken place.

The deposit occurs in a raft of limestone trapped in the San Christoval hornblende diorite batholith. The limestone is probably a remnant of the Kunga Formation. Locally, a few segments of altered volcanics are present and are probably part of the Karmutsen Formation. (Sutherland Brown, 1968; McDougall, 1964)

The skarn is a typical garnet - epidote body that completely replaces the lower portion of the limestone and all of the volcanics. Magnetite is hosted wholly within the skarn. The deposit is a large wedge that extends through the summit and is exposed on both sides. The body trends north northwest and plunges gently to the north. The northern end is approximately 50 feet (15 m.) thick while the southern end is wedge shaped with the west side a few tens of feet (several metres) thick and the east side 75 feet (23 m.) thick. Magnetite is variably mixed with skarn minerals as well as some pyrite and chalcopyrite. Individual samples of magnetite yielded values of 28 to 53 percent iron and 0.24 to 1.96 percent copper. Drill indicated reserves are estimated to be 200,000 tons (181,436 tonnes) containing 34.0 percent iron (McDougall, 1964).

The Apex claims were located in 1907 and work at that time included prospecting and driving an adit below the lowest outcrop of magnetite. The adit is 470 feet (143 m.) long and never struck ore (ibid.). In the early 1950's, ASARCO Ltd. mapped the deposit and drilled several holes. In the early 1960's, Wesfrob Mines Ltd. again mapped the area and drilled a few more holes. Following that work the property remained idle, initially waiting for development of the Tasu deposit. There has been no further activtiy at the site.

JIB, POOLE S36
TYPE: Skarn
A Prospect
Figure: 33

MINFILE: 103B 020
NTS: 103B 06
LAT: 52 21' LONG: 131 15'

The Jib claims cover the southeast corner of Burnaby Island and extend across Skincuttle Inlet to Skincuttle Island. The deposit is a large iron skarn essentially free of copper mineralization. A large portion of the deposit lies below Skincuttle Inlet.

The deposit consists of two skarn bodies associated with three different rock types. The stratigraphically youngest rock unit is the Kunga Formation. The lower 100 feet (30 m.) of the flaggy limestone and interbedded argillite sequence is present and below that is the full

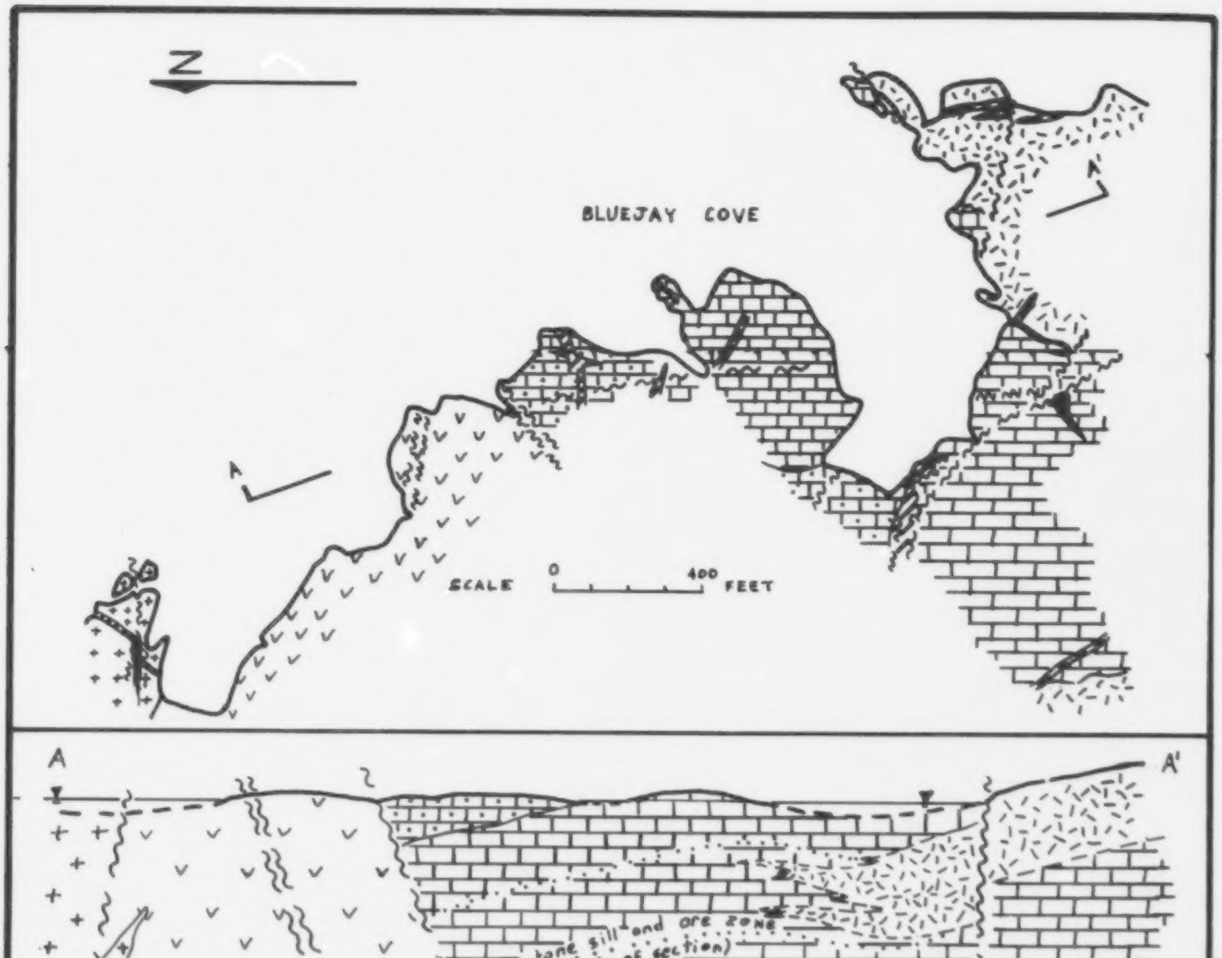
N
BLUEJAY COVE
A
A'
SCALE 0 400 FEET
A
A'
Greenstone sill and ore zone
(east of section)
SCALE 0 400 FEET
Kunga Flaggy Limestone
Kunga Massive Lst
Karmutsen Volcanics
fault
Post-ore dykes
Greenstone sills
Burnaby Batholith (quartz monzonite)
skarn
Sea level

Figure 33 : Sketch geology of the Jib, Poole deposit
(after Sutherland Brown, 1968)

section of massive blue - grey limestone. In both sections the limestones have been extensively bleached and recrystallized. Intruded into the massive limestone are sills of basaltic greenstone. These appear to be similar to the Karmutsen volcanics and may actually be flows representing the dying pulses of Karmutsen activity. Some question still remains as to which interpretation is correct (Sutherland Brown, 1968). Below the massive limestone are massive, amygdaloidal basaltic flows of the Karmutsen volcanics.

The major intrusive body is the Burnaby Island quartz monzonite batholith and its associated dykes and sills. There are also two other sets of dykes in the limestone. The first set of dykes are younger than the sills and are composed of diorite porphyry. The relationship of the dykes are not known as they do not outcrop on the property. They are only seen in the drill sections. However they do predate mineralization as they are partially replaced by skarn. The second set of dykes are basaltic andesites that are approximately the age of faulting. Paragenesis of the dykes is complex; some are associated with faulting and some follow the faulting and all post date the mineralizing event.

The stratigraphic section has been folded into an open, undulating sequence. The beds trend west and dip 10 to 25 degrees northeast.Folds trend east - west and plunge 10 - 20 degrees to the west. (Sutherland Brown, 1968, pp. 196). A bedding parallel cleavage is present in the limestones. Post dating the folding is normal block faulting. The result is a northwest trending graben structure, just off the shore of the island. The northern end is terminated by a large N45E trending normal fault. It appears that the whole southeast side has been down thrown 1,100 feet (336 m.). Displacement on all the other faults is between 50 and 150 feet (15 to 46 m.) (op. cit., pp.196). The block faulting predates ore mineralization and there has been a small amount of post ore movement.

The deposit, which is not exposed at surface, is large. Geological information comes as the result of drill exploration. The majority of the deposit lies under Skincuttle Inlet between Burnaby Island and Skincuttle Island. Drill work for Mastodon - Highland Bell Mines Ltd. and Leitch Gold Mines Ltd. between 1962 and 1965 delineated two ore zones, named the "Overlime" and the "Underlime" zones.

The Overlime zone, the higher grade deposit (Crowhurst, 1963), is an iron skarn replacement of the greenstone sills in the massive grey limestone. This body is approximately 200 feet (61 m.) thick and irregular in outline (Sutherland Brown, 1968, cross section). The body consists of a series of connected pods though not entirely continuous. The magnetite is generally massive with few impurities or areas of mixed skarn and magnetite. The whole deposit is encased in a rind of skarn, especially where it fingers out into the host rock.

The Underlime deposit consists of a more uniform section of skarn replacing volcanics at the base of the limestone. Locally the skarn does extend up into the limestone, possibly a feeder for the Overlime body (Sutherland Brown, 1968). On average, the Underlime body is 40 feet (12 m.) thick and elongate in a northerly direction. Magnetite is slightly more mixed with skarn minerals than the upper deposit. The skarn is called `typical' for the west coast by Sutherland Brown (1968). It is composed of epidote, pyroxene and garnet with the garnet more prevalent in the limestones than in the volcanics.

Reserve figures have been calculated for the deposit. The values are as follows:

Reasonably Assured:
  Overlime: 2,363,354 tons with 50.11 percent acid soluble iron (2,143,987 tonnes)
  Underlime: 62,500 tons with 46.17 percent acid soluble iron (56,699 tonnes)
Possible Ore:
  Overlime: 1,317,487 tons with grade unspecified (1,195,198 tonnes)

Impurities:			
	Copper	0.02	percent
	Sulphur	0.2	percent
	Phosphorous	0.05	percent
	Titanium	0.08	percent
	Silica(SiO_2)	7.5	percent
	Alumina(Al_2O_3)	1.5	percent

(after Crowhurst, 1963).

The reserves were calculated from the portion of the magnetic anomaly that could be drilled from land. There is a large portion of a significant magnetic anomaly off shore that could not be reached. It is believed that it is the continuation of the Overlime body. Subsequent to the reserves calculated in 1963, Highland Bell released figures of 8.2 million tons (7.44 megatonnes) of reserves with 49.45 percent soluble iron on the previously drilled section. It is not specified as to what type of figures these are (proven, probable, or possible). (Western Miner, 1965, October, pp. 97).

Original prospecting of the area was in 1862 to 1864 by F. Poole on some small copper showings. The claims lapsed and were restaked as the Red Raven group circa 1907. In 1961 Dennison Mines did an aeromagnetic survey of the area but did no followup ground work. From 1962 to 1965, Mastodon - Highland Bell Mines Ltd. and Leitch Gold Mines Ltd. did the drill exploration of the property. Subsequent to that there are no further reports of activity at the site. The Jib claims lie entirely within the bounds of the proposed South Moresby Island park.

THUNDER S37 MINFILE: 103B 041
TYPE: Skarn NTS: 103B 06
B Prospect LAT: 52 17' LONG: 131 09'

The Thunder claim lies on the east slope of the ridge that separates Collison Bay from Ikeda Bay. This is about 5 kilometres east of the town of Jedway. The deposit occurs as a series of iron skarn bodies in metavolcanic rocks.

Skarn is hosted by basic metatuffs of the Karmutsen Group. The beds are oriented approximately N30E and dip gently to the west. Overlying the limestones is the lower member of the Kunga Formation. (Sutherland Brown, 1968, pp. 212) Cross cutting the area are a series of post mineralization diorite dykes.

The skarn bodies are of two types : garnet skarns which follow the contact of the limestone and volcanic strata and garnet skarn bodies hosted entirely within the volcanic rocks. The first type is a zone at least 500 feet by 100 feet (153 by 31 m.). The second type comprises two similar tabular bodies, 200 feet by 10 to 15 feet (61 by 3 to 4.6 m.), oriented approximately N35E and dip steeply to the west. One of these bodies is cut by an adit 200 feet (61 m.) vertically below the surface out crop. These two bodies cross cut the stratigraphy. There is also a third pipe like body, but its dimensions are not specified. (op. cit., pp. 213; Young and Uglow, 1926, pp. 45 - 47)

Magnetite is generally massive and partially mixed with garnet. Locally, chalcopyrite and pyrite form pods within the magnetite. The magnetite mineralization at the contact zone occurs as a series of small, pure pods with the largest 45 feet by 15 feet (14 by 4.6 m.). Magnetite associated with the tabular bodies and the pipe is generally pure and massive. (Young and Uglow, 1926, pp. 48)

Work on the Thunder claim between 1907 and 1920 included a small amount of stripping, surface prospecting and adit development. Surface evaluation and geophysical surveys were done by Falconbridge Nickel Mines Ltd., Granby Mining Co. Ltd., and the Jedway Iron Ore Ltd. just prior to 1968 (Sutherland Brown, 1968, pp. 213). There are no other reports of activity on the property.

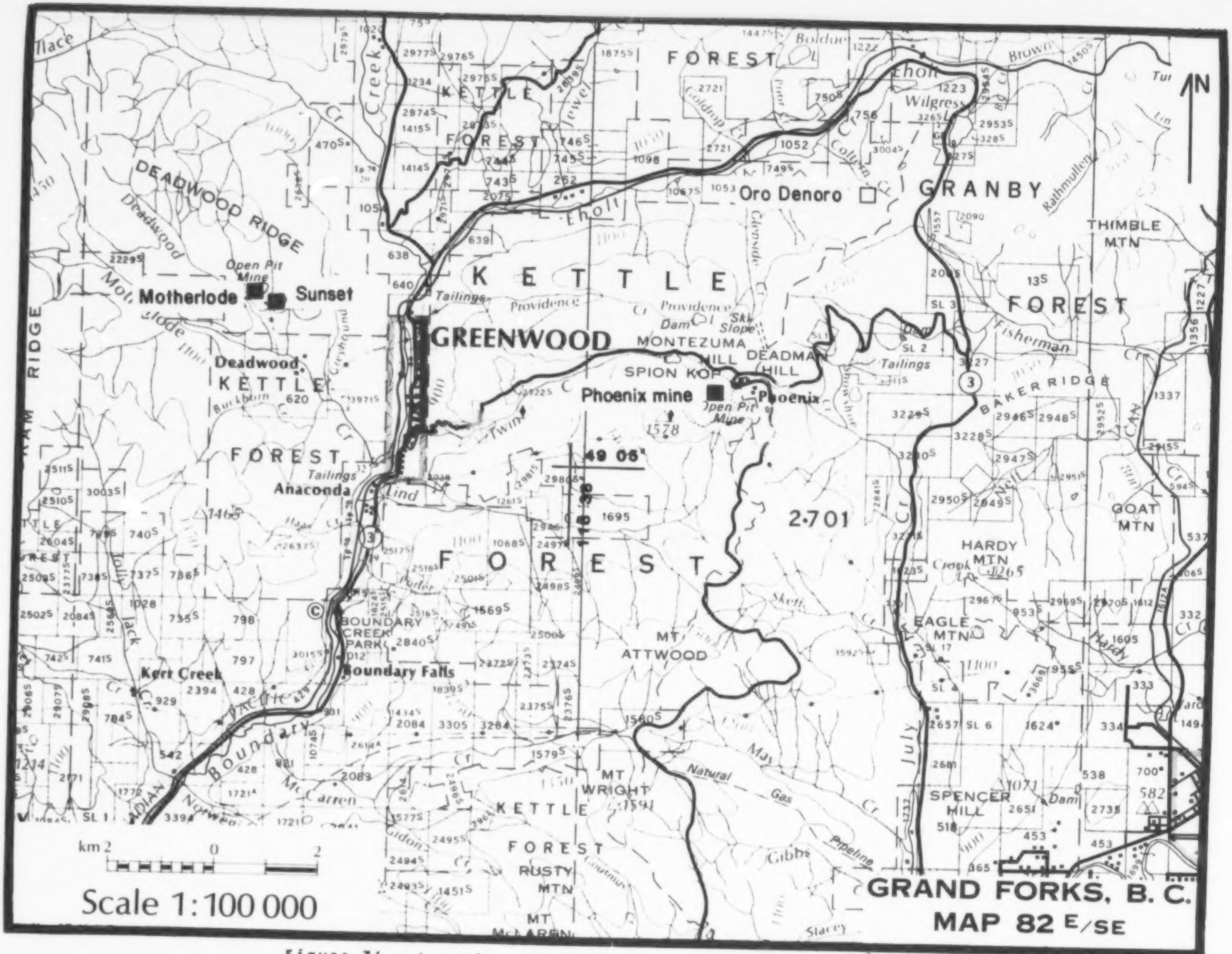
N
Motherlode
Sunset
Open Pit Mine
DEADWOOD RIDGE
Deadwood
KETTLE
FOREST
GREENWOOD
Anaconda
Tailings
Oro Denoro
GRANBY
THIMBLE MTN
FOREST
KETTLE
MONTEZUMA HILL
DEADMAN HILL
SPION KOP
Phoenix mine
Phoenix
Open Pit Mine
49 05'
118 38'
2·701
BAKER RIDGE
GOAT MTN
HARDY MTN
EAGLE MTN
FOREST
MT ATTWOOD
BOUNDARY CREEK PARK
Boundary Falls
Kerr Creek
MT WRIGHT
KETTLE
FOREST
RUSTY MTN
SPENCER HILL
Boundary
Eholt
Providence
Fisherman
July
Natural Gas Pipeline
km 2
0
2
Scale 1:100 000
GRAND FORKS, B. C.
MAP 82 E/SE

Figure 34 : Location of the Phoenix, Motherlode, Sunset and Oro Denoro mines

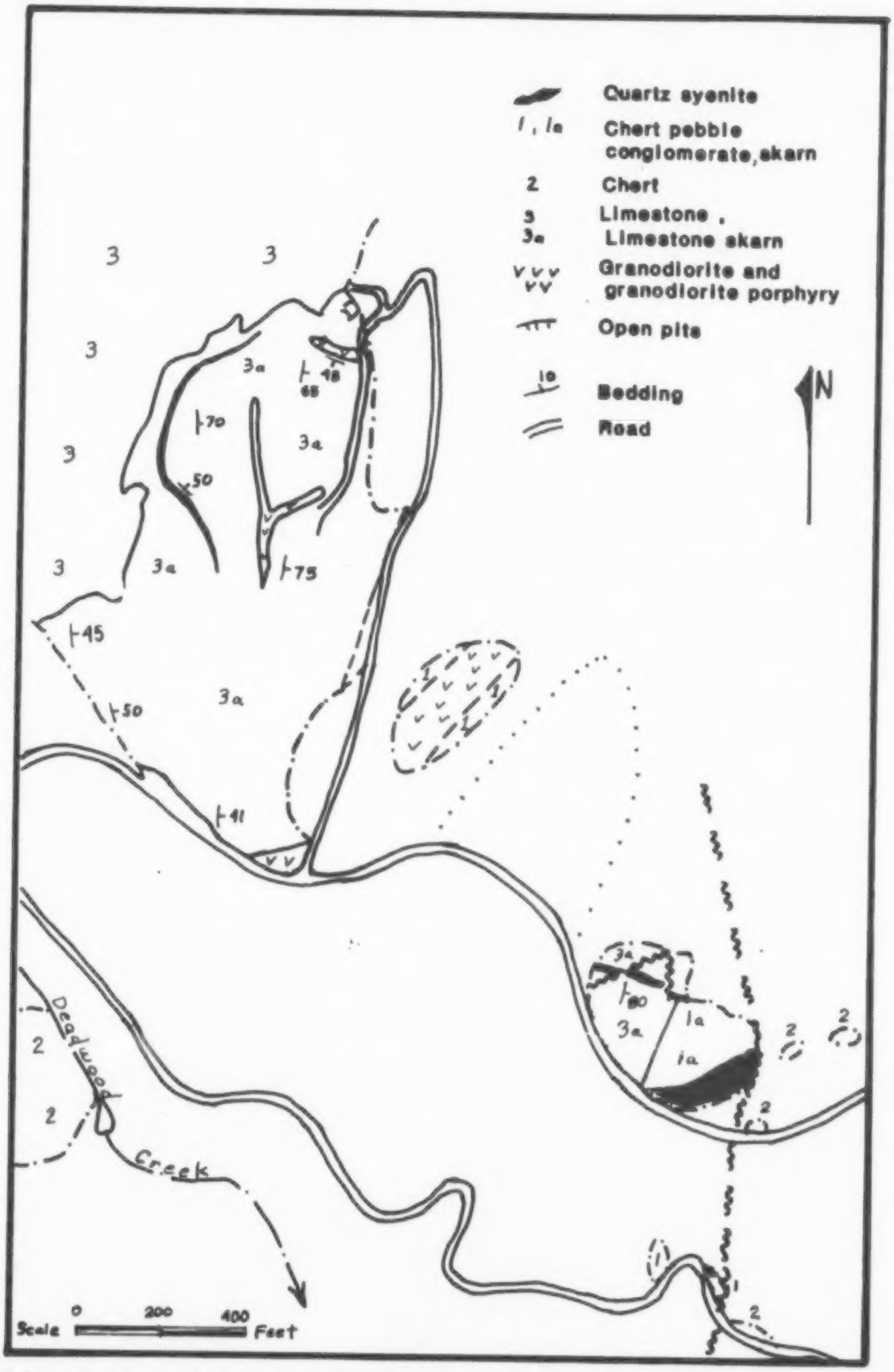
Quartz syenite
1, 1a Chert pebble conglomerate, skarn
2 Chert
3 Limestone,
3a Limestone skarn
Granodiorite and granodiorite porphyry
Open pits
10 Bedding
Road
N
3
3a
70
50
48
68
75
45
41
80
1a
2
Deadwood
Creek
Scale 0 200 400 Feet

Figure 35 : Sketch geology of the Motherlode and Sunset mines (after EMPR Annual Report, 1967 and AABRO Mining and Oils Ltd.)

MOTHERLODE MINE S38 MINFILE: 82E SE 034
TYPE: Skarn NTS: 82E 02
A Prospect LAT: 49 06' LONG: 118 44'
Figure: 34, 35

The Motherlode mine is located about three kilometres northwest of Greenwood. The majority of the production of the mine came in the early part of this century. The deposit is a large copper - iron skarn hosted in limestones.

Host rock is a large section of Triassic Brooklyn Limestone. This is underlain by jasperiod and cherty tuffs of the Permo - Carboniferous Knob Hill Group. (Church, 1986) The deposit rests entirely within a garnet - epidote - actinolite skarn. The mineralized zone is crudely crescentic in form with the long axis trending northeast and the crescent convex to the northwest. At depth, a large granite - granodiorite plug of Jurassic age intrudes the limestone. Tertiary pulaskite dykes crosscut the skarn body.

Mineralization consists of magnetite, chalcopyrite, and pyrite. Magnetite often formed a large part of the rock surrounding the chalcopyrite concentrations. Within the ore shoots, magnetite commonly comprised 80 percent of the total rock mass and otherwise formed 10 to 15 percent of the total rock mass. The estimated average magnetite content in the whole deposit was 15 to 25 percent. (Frederick, 1951) The relative abundance of magnetite increases with proximity to the intrusive plug. Magnetite concentration is known to increase with depth towards the intrusive plug, below the 200 level (Frederick, 1957). Magnetite occurs as dense crystalline masses throughout the deposit becoming more massive around the chalcopyrite ore shoots.

A smaller body of skarn, the Sunset mine, occurs to the southeast of the Motherlode deposit. The Sunset deposit is similar to the Motherlode deposit but with higher chalcopyrite and magnetite concentrations. Magnetite is more commonly 30 to 40 percent of the total skarn mass, increasing to 80 percent in the ore shoots. (Frederick, 1951) Historically, this body was worked in conjunction with the Motherlode mine.

The most complete reserve figures for the deposit come from AABRO Mining and Oils Ltd. (1967). The reserves are as follows:

Assured:	616,000 tons	(558,822 tonnes)
Indicated:	720,000 tons	(653,170 tonnes)
Inferred:	1,000,000 tons	(907,180 tonnes)

Cutoff grade for copper is 0.65 percent (after Allan Geological Engineering Ltd., 1967). The ore reserves were calculated for the ore above the 200 mine level. The most recent reports on the motherlode mine indicate reserves of 449,000 tons (407,324 tonnes) of ore at 0.65 percent copper, 0.015 oz. per ton (0.5 gm. / tonne) silver and 0.13 oz. per ton (4.46 gm. / tonne) gold (Mascot Gold Mines Ltd., 1984). The amount of magnetite in the reserves was not addressed.

The total production of the mine was 4.42 million tons (4.01 megatonnes) of chalcopyrite ore for the period 1901 to 1918, 1957, and 1959 to 1962. (Allan Geol. Engg. Ltd., 1967 ; GEM, 1971)

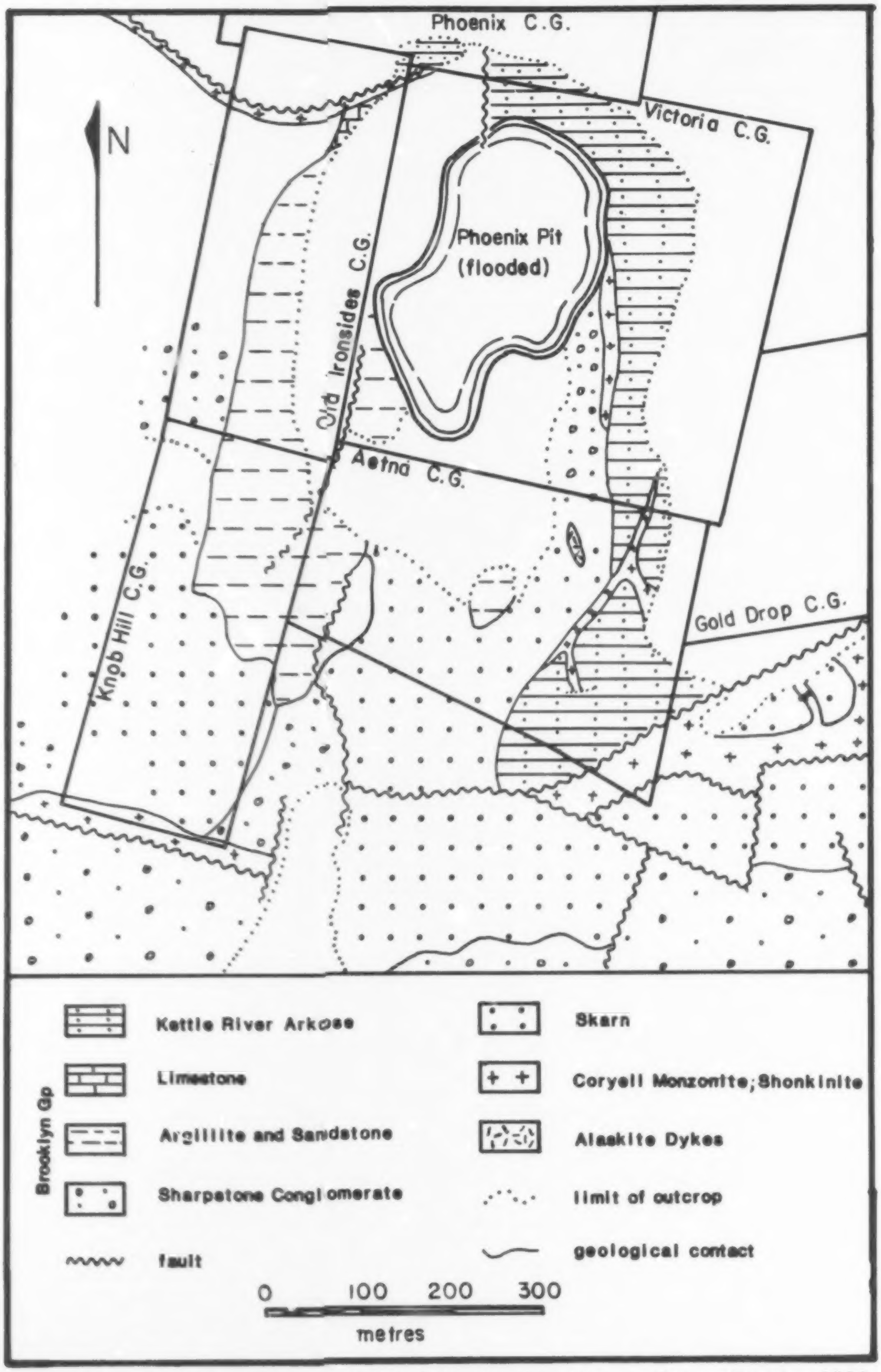
Phoenix C.G.
Victoria C.G.
N
Phoenix Pit
(flooded)
Old Ironsides C.G.
Aetna C.G.
Knob Hill C.G.
Gold Drop C.G.
Kettle River Arkose
Limestone
Argillite and Sandstone
Sharpstone Conglomerate
Brooklyn Gp
fault
Skarn
Coryell Monzonite; Shonkinite
Alaskite Dykes
limit of outcrop
geological contact
0
100
200
300
metres

Figure 36 : Sketch geology of the Phoenix deposit (after Church, 1986)

PHOENIX MINE S39 MINFILE: 82E SE 022
TYPE: Skarn NTS: 82E 02
A Prospect LAT: 49 06' LONG: 118 36'
Figure: 34, 36

The Phoenix mining camp has had a long and prosperous history of production in British Columbia. Copper and gold have been the main targets of mining activity throughout the years. The main part of the Phoenix camp consists of several mines on a large skarn ore body. Several other mines are proximal to the area and are believed to be remnant parts of the same system (Church, 1986). The main claim groups are the Aetna, Brooklyn, Gold Drop, Idaho, Knob Hill, Old Ironsides, Phoenix, Snowshoe, Stemwinder, and Victoria. Each claim had a small mine and collectively were operated by the Granby Mining, Smelting, and Power Corporation during the early part of this century. Ore bodies were mined for copper and gold while the magnetite portion was discarded as waste.

Mineralization is contained within a large skarn body that replaces Brooklyn limestone. The limestone is up to 2000 feet (610 m.) thick stratigraphically, but only a part of the lower section is present at the camp. Unconformably underlying the limestone are basement metamorphic rocks of the Knob Hill Group. The Brooklyn strata are folded into a monocline which strikes north and dips to the east. Dips at surface are 45 to 80 degrees and flatten to less than 20 degrees at depth within the limestone (LeRoy, 1912). Pre - ore northerly striking step faults that dip steeply to the east, offset the host sequence down to the east. Mineralization may be associated with the emplacement of the Greenwood granodiorite pluton which outcrops at surface about two kilometres west of the skarn and may occur below the skarn. (Church, 1986)

Skarn mineralization appears to be partly locallized by the faults in the limestone. Garnet with small amounts of epidote, diopside, and quartz completly replace the limestone. Other rocks are rarely replaced by skarn. Mineralization is completely enclosed by skarn and is often intermixed with it.

The ore body consisted of two large lenses joined at their centres. The western body was 2500 feet (750 m.) long, 40 to 125 feet (12 - 38) thick and 370 to 900 feet (112 - 275 m.) wide. The eastern body was similar in shape but of slightly smaller size (Church, 1986). Mineralization consisted primarily of magnetite, chalcopyrite, pyrite, and gold. Magnetite occurred as pods and lenses within the skarn, preferrentially near the lower contact with the metamorphic basement. Sulphides were found as disseminations, veins and pods within the skarn. The large amount of iron oxides, magnetite and some specularite, is due to the calcification of Fe - silicates and plagioclase of the granodiorite (Church, 1986). Metal grades of high grade ore were reported as 2 to 5 per cent copper and 16 percent or better magnetite during production. (LeRoy, 1912).

Exploration in the area began in the late 1800's. The first properties staked were the Stemwinder and the Old Ironsides, in 1892, and by 1900 the first shipments of ore were made. Work continued until 1919 when the mine was closed due to insufficient grades for underground methods. Total production was just over 14 million tons (12.7 megatonnes) of ore mined from the Stemwinder, Old Ironsides, and Gold Drop properties.

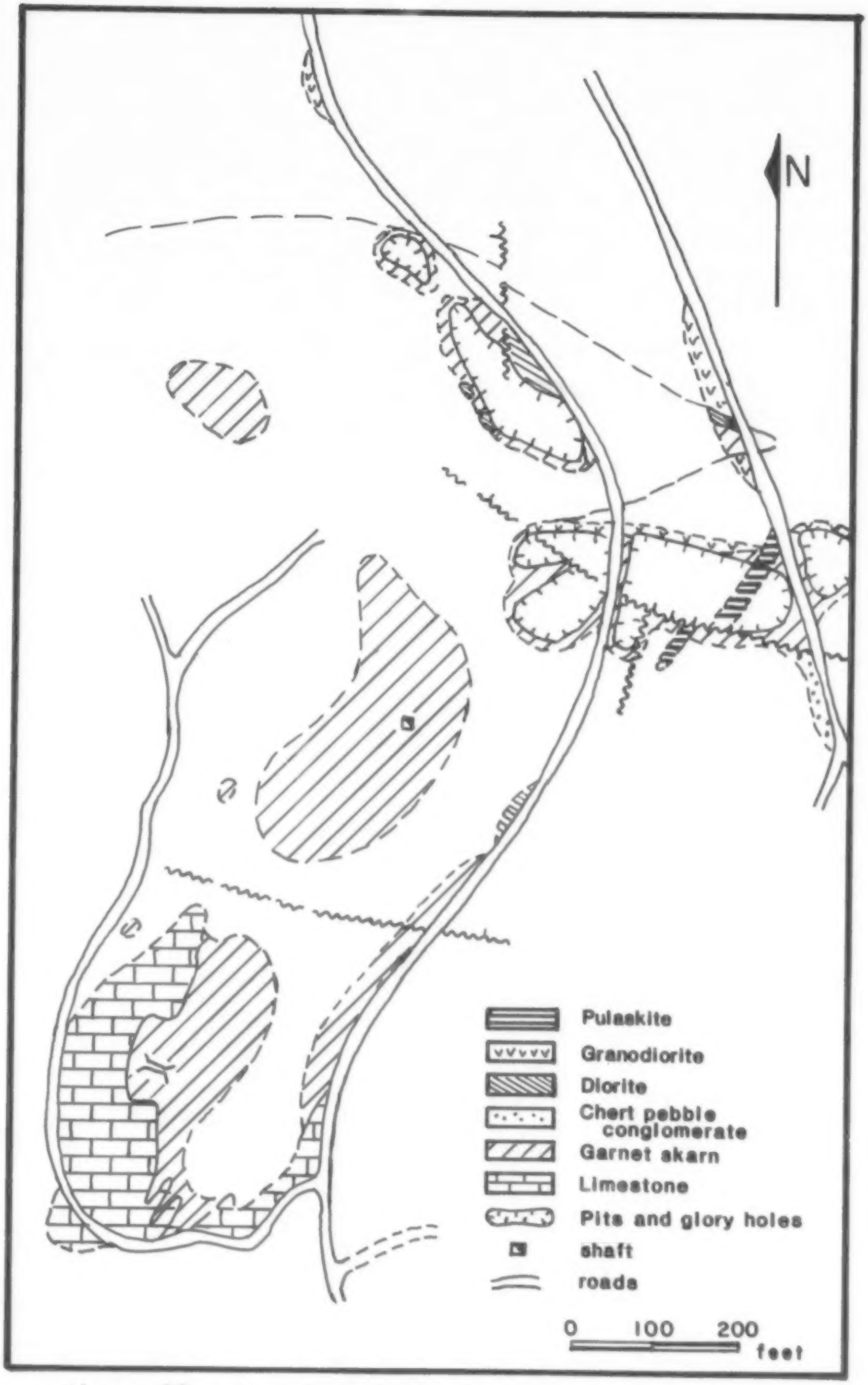
N
Pulaskite
Granodiorite
Diorite
Chert pebble conglomerate
Garnet skarn
Limestone
Pits and glory holes
shaft
roads
0
100
200
feet

Figure 37 : Sketch geology of the Oro Denoro deposit (after EMPR Annual Report, 1968 and West Coast Resources Ltd.)

In 1959, the Phoenix Copper Company began open pit mining of the Phoenix copper deposit. The magnetite portion of the ore was discarded with the waste rock. In 1974 the open pit operation was shut down while the mill processed the last of the stockpiled ore. During that same year, reclamation of the properies commenced. Total production for the Phoenix mine from the Old Ironsides, Knob Hill, and Victoria claims for the period 1900 to 1976 was 26,956,525 tons (24.5 megatonnes) of ore. The Gold Drop mine produced 1,600,582 tons (1.45 megatonnes) of ore up to 1919 and the Brooklyn, Stemwinder, and Idaho operations produced 291,954 tons (264,855 tonnes) of ore between 1900 and 1949 (Church, 1986). The percentage of magnetite in the tailings is not known.

ORO DENORO S40 MINFILE: 82E SE 063
TYPE: Skarn NTS: 82E 02
A Prospect LAT: 49 07' LONG: 118 32'
Figure: 34, 37

The Oro Denoro mine lies 10 kilometres northwest of Greenwood and forms the core of the Summit mining camp. The deposit is a copper - iron skarn hosted in limestones. The mine produced copper and still has reserves which include a large volume of magnetite (Church, 1986).

Host rock to the ore mineralization is the Brooklyn limestone adjacent to the Wallace Creek Batholith. The limestone has been folded. Bedding at the mine trends north and dips steeply to the west. Underlying the limestone are sharpstone conglomerates, tuffaceous sediments, and fine grained volcanic breccias. The limestone has been partially replaced by garnet - epidote - calcite skarn. Approximately 90 percent of the skarn is composed of zoned green - brown garnet (Church, 1986,). The presence of the skarn is associated with the Wallace Creek batholith.

Mineralization consists of magnetite, chalcopyrite, and pyrite. The sulphides are situated in several discrete zones within the skarn. Chalcopyrite often is hosted in lenses of magnetite and these were mined only if the copper grades were great enough. Potentially a large amount of magnetite remains in place at the Oro Denoro site.

The majority of production from several surface quarries and some underground workings was achieved from 1903 to 1917. Copper and gold were the products of the mine. The magnetite and limestone combination in the ore created a fine self fluxing ore at the Phoenix smelter. At the close of the mine a large amount of 0.5 percent copper ore was left in the ground (Church, 1986). Since then work on the property has been sporadic. Several large drill programs have crossed the site in the 1960's and the 1970's. In 1979 several thousand tonnes of loose ore were shipped to the Phoenix mill. Since then no production has been recorded.

DEER PARK HILL S41 MINFILE: 82F SW 122
TYPE: Skarn NTS: 82F 04
B Prospect LAT: 49 03' LONG: 117 49'

The Deer Park hill mine is located on the southeastern slopes of Deer Park hill, 2 kilometres south of Rossland. The claim is part of the Rossland South Belt mineralization (Fyles, 1984, pp. 39). The mine worked a small gold bearing vein. A large, previously poorly documented skarn body is also present.

Host rocks to all the mineralization are siltstone, hornfelsed siltstone, volcanic conglomerates, and augite porphyries of the Rossland Group (ibid.). The skarn is immediately south of, and adjacent to the Rossland monzonite stock (Drysdale, 1915, pp. 164). Actinolite, occurring as fine fibrous, radiating masses, is the most common alteration mineral. Metallic minerals include magnetite, pyrrhotite, pyrite, and small amounts of gold and silver. These are often found as massive, mixed aggregates in the actinolite skarn. At the mine, a 60 foot (18 m.) shaft and a 47 foot (14 m.) crosscut were cut in `low grade' massive pyrrhotite mineralization. Of that, 46 feet (14 m.) (shaft and / or crosscut not specified) were cut in massive magnetite skarn (Drysdale, 1915, pp. 163 - 4).

The Deer Park mine was developed in the late 1890's and the early 1900's. The continuity and grade of the gold mineralization was difficult to follow and so the property was worked only occasionally. Several shafts, drifts and cross - cuts were made, generally in low grade copper ore. A few thousand tons of copper - gold ore were shipped over the course of the life of the mine (Fyles, 1984). This mine is the best documented example of the magnetite skarns found along the contact of the Rossland stock in the Rossland camp. Several other claim reports mention the actinolite - magnetite mineralization in passing. However the main thrust of development was on the gold bearing veins.

McKINLEY S42 MINFILE: 82E NE 001
TYPE: Skarn NTS: 82E 09
A Prospect LAT: 49 32' LONG: 118 23'

The McKinley claim was one of the pioneer claims of the Franklin / McKinley mining camp. The property is 55 kilometres north of Grand Forks, on the north slope of McKinley mountain. The deposit is a copper - iron skarn.

Mineralization is hosted in the Paleozoic Glouchester marbles that are adjacent to and overly the Franklin volcanic package. Broad regional folding has deformed the succession and emplacement of a Jurassic granodiorite has further tilted the whole sequence to the east. The regional thermal effect of the pluton caused the recrystallization of the limestone to marble and alteration of the volcanics. (Drysdale, 1915)

Mineralization at the camp consists of three types of skarn: pyrite - chalcopyrite; galena - sphalerite; and magnetite - pyrite. Skarn occupies the contacts between the volcanics and marble, preferrentially replacing the marble. Contacts are sharp between the skarn and marble and are gradual between the skarn and volcanics. The zone of mineralization is up to 100 feet (30 m.) wide. Magnetite occurs as crudely tabular bodies and lenses within the skarn. Although magnetite is reported as occurring in significant amounts, the quantity and grade are not reported (ibid.).

The property was originally staked in 1901 on a series of copper showings. On the McKinley claim a substantial amount of drifting and surface work was done. Several tens of tonnes of picked ore were shipped during development but no real mining production was done. Magnetite was not of primary concern so it is only mentioned in passing. By the early 1920's activity at the Franklin / McKinley camp dwindled. Since then only sporadic activity has been recorded for the McKinley claim.

BLUEBELL S43 MINFILE: 82E NW 026
TYPE: Skarn NTS: 82E 13
B Prospect LAT: 49 48' LONG: 119 50'

The Bluebell showings lie on Peachland Creek, 13 kilometres northwest of Peachland.

Showings are hosted in a regional raft of Triassic Nicola Group volcanic and sedimentary rocks surrounded by the Nelson granitic intrusion. Limestone and quartzite beds are present on the property. The strata trend north northeast and dip gently to the east. The limestone beds average 6 feet (2 m.) thick. The strata are cut by andesitic greenstone dykes that are mineralized with pyrite, pyrrhotite, chalcopyrite, and sphalerite. Massive pods and lenses of magnetite are found in skarn replacements of the limestone beds. Some chalcopyrite and pyrrhotite is associated with the magnetite. The mineralized rocks are extensively covered by glacial drift. The largest natural showing is 10 feet by 15 feet (3 by 4.6 m.). Only a limited amount of surface work has been done including a geophysical survey. (MMAR, 1964, pp. 103 - 4)

DIVIDEND, LAKEVIEW S44 MINFILE: 82E SW 001
TYPE: Skarn NTS: 82E 04
B Prospect LAT: 49 02' LONG: 119 27'

The old Dividend mine is situated on the southern slopes of Kruger Mountain, 3 kilometres west of Osoyoos, and 1.6 kilometres north of the international border. The deposit is a copper skarn hosted in rocks of the Anarchist (Kobau) series (Cockfield, 1935, pp. 20 - 26).

Host rocks to the mineralization are volcanics, schists, and limestones of the Anarchist series. The limestone appears as dissected pods and lenses in surrounding schists and quartzites probably due to intense deformation. (ibid.). Intruded into the strata is a body called the "altered diorite" as plagioclase have been completely saussuritized and pyroxenes chloritized. Relict textures indicate the original rock was holocrystalline (MMAR, 1962, pp. 66). To the north, just off the Dividend claim is the southern margin of the Osoyoos diorite pluton. It is this pluton that is responsible for the skarn mineralization (ibid.).

Skarn mineralization generally replaces the limestone lenses and the volcanic greenstones. As well, the "altered diorite" has been partly altered to skarn and hosts some metallic mineralization. The major alteration minerals are garnet, epidote, diopside, and wollastonite. The skarn roughly follows the bedding of the host strata.

Mineralization consists of pyrrhotite, magnetite, chalcopyrite, arsenopyrite and some gold disseminated throughout the skarn. Magnetite is more prevalent in some areas. The degree and areal extent of magnetite mineralization is not specified but it is inferred to exist throughout the mineralized horizons. The single developed ore shoot is exposed in a Glory Hole of several hundred square feet and about 190 feet (58 m.) below surface at the No. 3 level (Cockfield, 1935, pp.23).

The Dividend and Lakeview claims were originally staked in 1900. Prospecting at surface and underground was carried out at a small scale for several years. In 1912 and 1913 several small shipments of ore were made. The greatest production was for the years 1936 to 1941. The total production of the mine was 122,363 tons (111,005 tonnes) and this came from the Glory Hole and the underlying stopes (MMAR, 1963, pp. 66). There are a few reports of surface activity during the 1960's and only one mention of work done in 1980 (Rideau Resources Corp.). Only small amounts of surface work have been done since the close of the mine.

BULLION S45 MINFILE: 82E SW 013
TYPE: Skarn NTS: 82E 05
B Prospect LAT: 49 16' LONG: 119 49'

The Bullion claim lies on the hill slope 1 kilometre east of the town of Olalla, 8 kilometres north of Keremeos.

The deposit is a copper - iron skarn hosted in limestones and argillites overlying Shoemaker sediments. These are intruded by gabbro and diorite dykes on the north side of the Olalla pyroxenite stock (MMAR, 1962, pp. 64). The skarn is primarily made up of garnetite and lime (calcite ?) (MMAR, 1904, pp. G225). Mineralization consists of magnetite, pyrite, and chalcopyrite.

The claim was originally worked between 1899 and 1905. Three adits were driven, for a total of 1500 feet (458 m.), and one shaft, 100 feet (31 m.) deep (MMAR, 1908, pp. J117). There are no reports of production from the workings. Interest was rekindled in 1928 when several small showings of nickle carbonate were recognised in the workings. The claim then remained idle until 1962 when a small surface mapping and evaluation was done (MMAR, 1962, pp. 64). Since then no work has been done on the property.

IRON MOUNTAIN, BRENDA S46 MINFILE: 93B 004
TYPE: Skarn NTS: 93B 08
B Prospect LAT: 52 27' LONG: 122 16'

The Iron Mountain claims lie 4.8 kilometres northwest of McLeese Lake, on the southern slopes of Granite Mountain. The deposit is a skarn in a block of metasedimentary rocks.

The metasedimentary package is primarily composed of thin bedded tuffs, greenschists with less schistose volcanic breccias, and scattered limestone lenses. The lenses become thinner from east to west across the package. Bedding and foliation strike east and dip moderately to the south. North of the metasedimentary package is a large stock of foliated granodiorite which is more dioritic in the area of the deposit. (MMAR, 1957, pp. 16; Crosby, 1956)

Magnetite occurs as a series of discrete lenses that parallel bedding and foliation. These lenses commonly occur along the contacts of the limestone with the volcanic rocks. A thin rind of garnet - epidote - pyroxene skarn encloses each magnetite lens. Often associated with the magnetite are specular hematite and some chalcopyrite (MMAR, 1957, pp. 16). Individual lenses range from a few inches to several feet (cm. to m.) thick and are often tens of feet (> 3 m.) long with the whole zone of mineralization tracable for at least 3,500 feet (1,068 m.) (Crosby, 1956). The largest lens is 6 feet (2 m.) wide and 200 feet (61 m.) long (MMAR, 1957, pp. 16).

The Iron Mountain claims were staked over showings of copper mineralization that were known in the early 1900's. (MMAR, 1925, pp. A156). More recent work on the showings began in 1956 and carried on occasionally over the next few years. The main thrust of investigation was the copper mineralization but a modest zone of magnetite was identified.

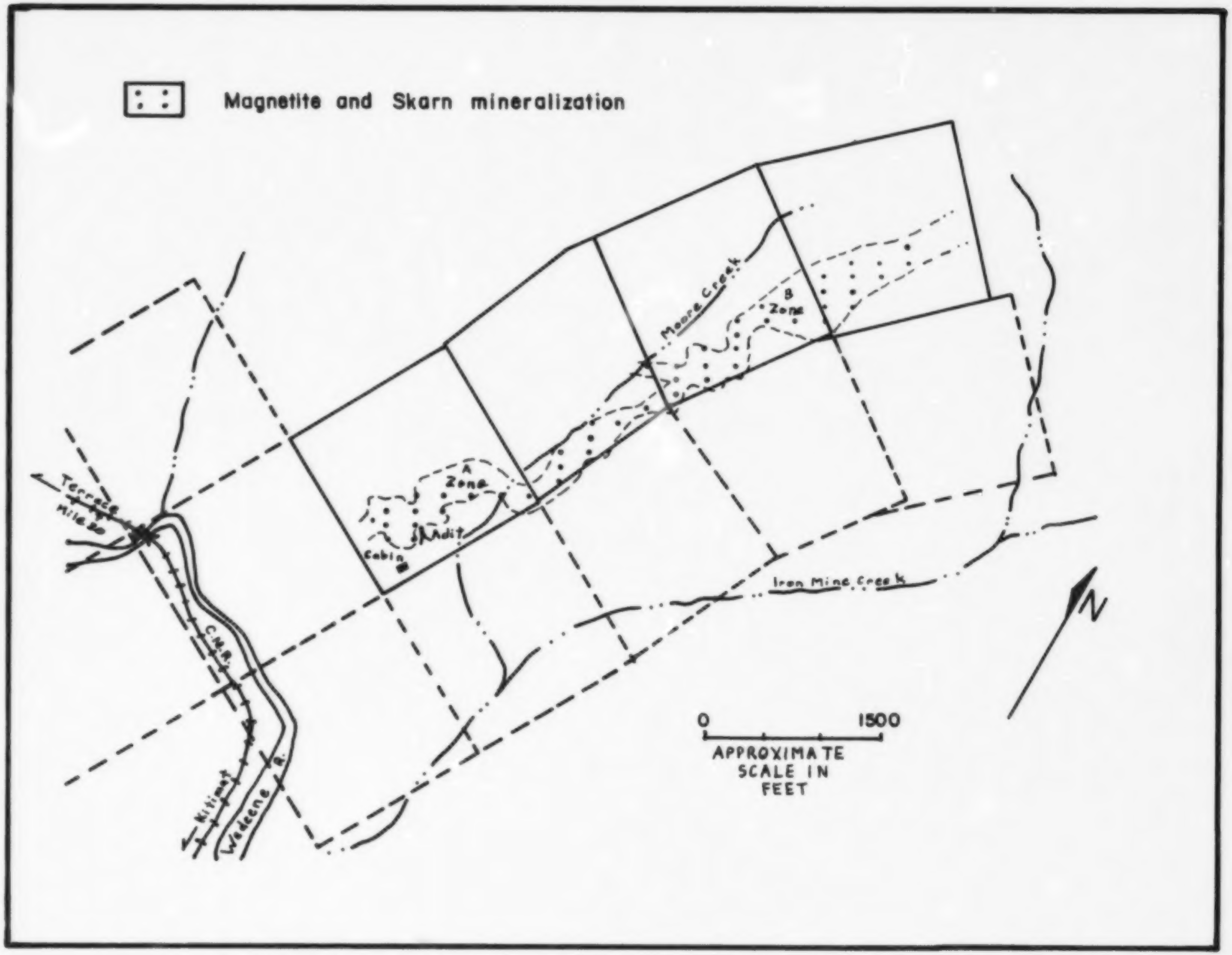
Magnetite and Skarn mineralization
Moore Creek
B Zone
A Zone
Adit
Cabin
Terrace
Mile 20
C.N.R.
Kitimat
Wedeene R.
Iron Mine Creek
N
0
1500
APPROXIMATE SCALE IN FEET

Figure 38 : Sketch of mineralization at the Wedeene deposit
(after Indusmin Ltd., 1958)

WEDEENE, BIMETALLIC S47 MINFILE: 103I 014
TYPE: Skarn NTS: 103I 02
A Prospect LAT: 54 10' LONG: 128 39'
Figure: 38

The Wedeene iron deposit is adjacent to the railway, 13 kilometres due north of Kitimat, on the southeast slopes of Iron Mountain. The deposit occurs as a long inline series of skarn bodies. A moderate tonnage of low grade magnetite has been delineated.

The zone of mineralization is hosted in a package of middle Jurassic volcanics. These rocks are andesitic in composition, fine grained and regionally altered to greenstone proximal to a large pluton. Bedding features are not readily found but airphoto interpretation indicates a northwest strike and southwest dip (Lazenby, 1962). The volcanics and greenstones occupy most of the southeast slopes of Iron Mountain. Intruded into the volcanics is a large upper Cretaceous batholith. In the vicinity of Iron mountain this body is a dark grey diorite.

Four types of dykes are found throughout the deposit area. There is one phase of mafic, preore dykes which are so altered as to resemble the surrounding greenstone. As well there are a few lamprophyre dykes, not specified as pre- or post- ore, that are substantially altered. There are two types of post ore dykes. The first is a biotite rich mafic series in which some of the biotite is altered to chlorite. The second appears to consist of younger felsic dykes, some of which approach pure quartz in composition. The dykes all appear to have northerly strikes with steep dips. (Lazenby, 1962)

Faulting on the property is significant. It is believed that the zone of mineralization follows a north northeast trending shear. Crosscutting the deposit are a series of north trending faults that are probably splays of a nearby regional feature. (ibid.)

The mineralized zone is tracable across the southeast slopes of Iron Mountain for approximately 3,200 yards (2928 m.). It strikes 010 / 75 W and is up to 300 feet (92 m.) wide (MMAR, 1908, pp. J57). The skarn is no less than 500 feet (153 m.) from the intrusive contact with the volcanics (MMAR, 1961, pp. 18). It consists of spessartine garnet and epidote.

Mineralization consists of magnetite and minor disseminated pyrite. Magnetite appears as lenses in the skarn, parallel with the controlling shear zone. Individual lenses are elongate and reach dimensions of 500 feet by 40 feet (153 by 12 m.) (MMAR, 1929, pp. C72). As well, magnetite is disseminated throughout the skarn. Areas of dense magnetite mineralization, up to 90 percent by volume, contain up to 70 percent soluble iron. (Lazenby, 1962) Two major deposits were identified on the property. The "A" zone is on the lower southern slopes and the "B" zone (Summit zone) is near the highest outcrops of the group.

Drilling on the site blocked out the following reserves:

A zone	2,419,318 tons with 22.62 percent soluble iron (2.19 megatonnes)
B zone	3,484,142 tons with 21.73 percent soluble iron (3.16 megatonnes)
Total	5,903,460 tons with 22.09 percent soluble iron (5.36 megatonnes)

(after Lazenby, 1962).

Drilling has been shallow and it is estimated that more magnetite can be found down dip. The northern extention also remains open. A maximum of 10 million tons (9 megatonnes) of 20 percent soluble iron is postulated (ibid.).

The Wedeene iron deposit was staked as the Bimetallic prior to 1903. Some surface work and driving of adits was done sporadically over the subsequent 30 years. During that time there was some restaking and the Mineral Hill claims appeared. From 1958 to 1962 Quebec Metallurgical Industries carried out a surface geological and geophysical survey augmented by packsack drilling. It was at that time the ore reserves were calculated. There are no further reports of activity on the property since then.

DEAN CHANNEL S48 MINFILE: 93D 004
TYPE: Skarn NTS: 93D 10 / 11
B Prospect LAT: 52 40' LONG: 127 01'

The Dean Channel iron claims lie just west of Engerbrightson Point, about half way up the north side of Dean Channel from Laboucher Channel. This deposit is an iron skarn in chloritic schists.

The chlorite schist body is approximately 300 feet wide (92 m.) and extends up from the water past the upper limit of the claims. Foliation of the host trends north and dips vertically. Both sides are bounded by a sheared diorite that carries rotated blocks of partially stoped schist. (Young and Uglow, 1926, pp. 52 - 53). The area is covered with drift so the full extent of the host or mineralization is not known.

Known exposures of the zone of mineralization cover an area 100 feet (30 m.) across and 275 feet (84 m.) up slope. Epidote - garnet skarn is found as sheets parallel to the foliation and as rinds around the massive magnetite bodies. The magnetite has two modes of occurrance. One is as large, pure, massive pods and the other is as thin stringers parallel to the foliation. Massive magnetite pods are free of all impurities, including sulphides. An exposure in an old quarry face shows a body of magnetite 30 feet (9 m.) wide at the base and branching upwards with one arm 4 feet (1.2 m.) wide. Other cuts show pods and lenses of pure magnetite up to 6 feet (2 m.) wide. The stringers are magnetite mixed with skarn minerals up to a few inches (centimetres) wide in zones 10 to 15 feet (3 to 4.6 m.) wide (ibid.) The complete area of mineralization is not known but it does not reach the shore as it is terminated near there by an intrusion of hornblende diorite (ibid.)

The Dean Channel iron claims were worked in 1917 at which time a bulk shipment of 1,200 tons (1,088 tonnes) of ore were delevered to a Seattle firm for experimental purposes (MMAR, 1919, pp. N86). There has been no subsequent activity on the property.

LAVERDIERE GROUP S49 MINFILE: 104M 022
TYPE: Skarn NTS: 104M 01
B Prospect LAT: 59 13' LONG: 134 07'

The Laverdiere group of claims lies on the west side of Hoboe Creek, 3 kilometres south of Willison Bay, Atlin Lake. The deposit is a large iron skarn.

Mineralization is hosted by lower Paleozoic, Mount Stephens Group strata [note: The Mt. Stephens Group is an archaic term. This is mapped as Jurassic to lower Cretaceous Coast Intrusive igneous and metamorphic rocks by L. J. Werner in 1978]. Locally these consist of dolomitized limestones and siltstones which strike northerly and dip moderately to the west. (Cairnes, 1910, pp. 117 - 121) Above these and to the west are granodiorite intrusive rocks of the Coast Plutonic Complex. At the property the intrusion appears to conformably overly the sedimentary rocks (White, 1969).

The zone of mineralization follows the contact of the intrusion for approximately 3000 feet (915 m.) (ibid.). Skarn replaces dolomitic limestone at or near its contact with a siltstone layer adjacent to the intrusion. The zone of alteration is parallel to the bedding and varies in thickness from 10 to 150 feet (3 to 46 m.) but is commonly 20 to 40 feet (6 to 12 m.) thick (White, 1969). Where exposed in the drift, the mineralization suggests continuity along the full 3000 foot (915 m.) contact. (ibid.)

Mineralization consists of massive magnetite mixed with yellow and green garnet (ibid.). By volume, the magnetite is the major component of the skarn. Locally, chalcopyrite and pyrite are found mixed with the magnetite. Visual analysis of the skarn rock indicate tetrahedrite and cobalt bloom are present in small amounts. (White, 1969)

The Laverdiere claims were Crown granted in 1903. Workings at the time consisted of four adits and some surface strippings. The longest cross cut adit is 180 feet (55 m.) long and showed 130 feet (40 m.) of continuous mineralization (MMAR, 1918, pp. K94). Work continued until sometime shortly after 1918. In 1964, drilling of five diamond drill holes and surface mapping was done by Cominco Ltd. (MMAR, 1964, pp. 8). The latest work included surface work and mapping in 1969 and 1974 by Rio Plata Silver Mines Ltd..

MAGNO, GRAHAM S 50 MINFILE: 104P 006
TYPE: Skarn NTS: 104P 04
B Prospect LAT: 59 15' LONG: 129 49'

The Magno claim group lies on the west fork of Marble Creek, approximately 4 kilometres south of Cassiar. The deposit is a magnetite - lead - zinc skarn associated with shear zones.

Host rocks are marmorized limestone of the Lower Cambrian Atan Group (Gabrielse, 1963, pp. 120 - 122). Bedding trends north and dips moderately to the east. The limestone has been locally dolomitized around the magnetite mineralization and sporadically in small irreguler bodies in the area. East - west trending faults and fractures cross cut the strata. These structural features control the mineralization (ibid.).

Mineralization consists of manganiferous magnetite and argentiferous galena with some sphalerite, smithsonite, and hydrozincite. The main zone of mineralization is a shear that transects the property for 3000 feet (915 m.). The zone strikes east - west, dips 70 to 80 degrees north, and is 40 feet (12 m.) wide. Mineralization is concentrated in shoots 60 to 90 metres long and up to 8 metres wide (MMAR, 1976, pp. E198). Dolomitization is greatest around zones of magnetite mineralization. Magnetite is the most abundant mineral present, with sulphides restricted to the eastern portion of the zone. Drill work in 1975 and 1976 delineated three blocks of silver - lead ore. A total of 486,000 tons (440,889 tonnes) of reserves (proven, possible, probable) were determined (Cukor, 1976).

The Magno claims were first staked on galena showings in Marble Creek in 1941. In 1954, 22.5 tons (20 tonnes) of picked ore from bulldozer strippings were shipped for testing. Subsequently the showings were stripped to determine the extent of mineralization. In 1971 and 1972 a small amount of underground exploration was done from two adits (Coast Silver Mines Ltd.). Then through 1976 a series of small drill exploration programs were executed (Balfour Mining Ltd.). There are no further reports of work on the property.

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Magmatic Differentiated Magnetite Deposits

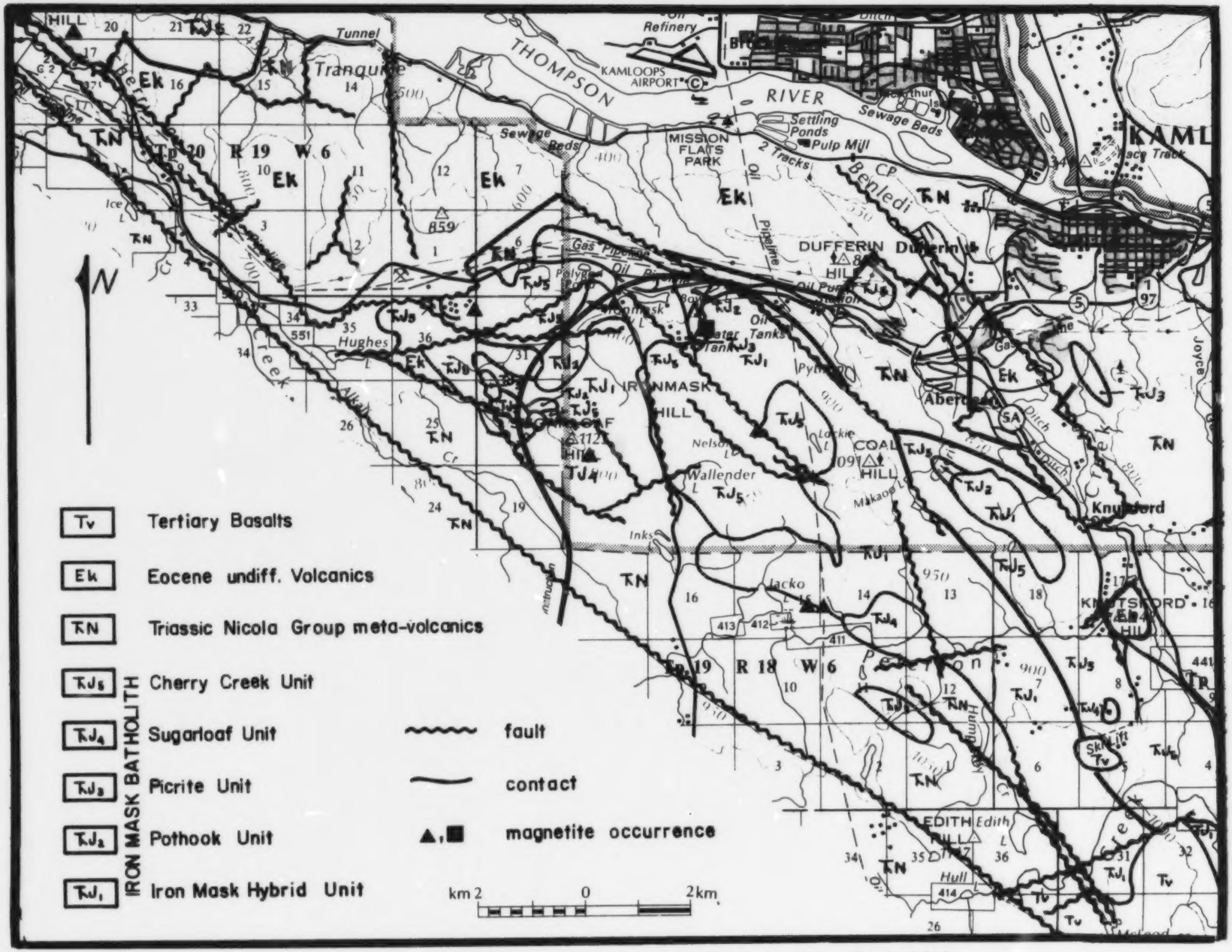
Magnetite deposits derived from differentiated melts are an unusual phenomenon. The only location in the province of this kind of deposit is the Iron Mask Batholith complex, located immediately southwest of Kamloops. The body is a multiple phase alkalic batholith about 22 kilometres long and 6 kilometres wide at surface. It is roughly ellipsoidal, with the long axis trending northwest.

There are five major rock types in the batholith, the result of magmatic differentiation and multiple intrusive events. These units are a picrite basalt, the Iron Mask Hydrid unit, the Pothook unit, the Sugarloaf unit, and the Cherry Creek unit (R.M. Cann, 1979). The picrite basalt occurs as lenticular pods, often serpentenized, in fault zones. The Iron Mask Hybrid unit is agmatitic, containing angular clasts of diorite, gabbro, and Nicola volcanics within a matrix of leucocratic diorite. The Pothook unit is a mafic rich diorite phase which occurs in a gradational zone between the Iron Mask Hybrid and the Cherry Creek units. The Sugarloaf unit is a grey green hornblende diorite. Of significant note is the almost complete lack of magnetite within this unit. The Cherry Creek unit, on the north margin of the batholith, consists of several rock types ranging from diorite to syenite. It has been suggested that the variety of phases represents repeated tapping of the magma chamber during emplacement. The batholith is of Triassic age.(Cann, 1979)

The mineralization within the Iron Mask batholith is of two types; copper porphyry systems and massive magnetite bodies. Copper mineralzation occurs as stockworks, veins and disseminations. Chalcopyrite is the dominant mineral and bornite occurs sporadically in small amounts. The copper deposits tend to be near the batholith margins, and are associated with east - west trending fault zones, Cherry Creek intrusion breccias, and potassic alteration zones. (Kwong, 1988)

Magnetite mineralization is of two types. The first is disseminated magnetite in the basic and ultrabasic rocks, with concentrations ranging from trace amounts to 15 percent in the picrites and averaging 5 - 10 percent (Cann, 1979). The second type are magmatic - injected lode ores. These are large massive, tabular bodies of nearly pure magnetite that often parallel major easterly or northwesterly trending lineaments. The association between structures and lodes suggests that magnetite was emplaced in zones of structural weakness (ibid.). The magmatic - injected bodies tend to be locallized in the northwest end of the batholith, adjacent to late stage Cherry Creek intrusive phase.

Two major fault sets occur in the batholith, one trends east - west and the other, northwest - southeast. It appears that most movement occurred during emplacement of the batholith. Post mineralization faulting exists but no significant displacements have been observed.



Tv Tertiary Basalts
Ek Eocene undiff. Volcanics
TRN Triassic Nicola Group meta-volcanics
IRON MASK BATHOLITH
TRJ5 Cherry Creek Unit
TRJ4 Sugarloaf Unit
TRJ3 Picrite Unit
TRJ2 Pothook Unit
TRJ1 Iron Mask Hybrid Unit
fault
contact
▲,■ magnetite occurrence
km 2
0
2km
N
THOMPSON
RIVER
KAMLOOPS AIRPORT
Refinery
Tunnel
Tranquille
Sewage Beds
Settling Ponds
Pulp Mill
2 Tracks
MISSION FLATS PARK
Oil Pipeline
Gas Pipeline
Benledi
CP
DUFFERIN HILL
Dufferin
IRONMASK HILL
SUGARLOAF HILL
COAL HILL
EDITH HILL
Aberdeen
Knutsford
KNUTSFORD
Hughes L
Nelson L
Wallender L
Lackie L
Makaoo L
Jacko L
Inks L
Ice L
Hull L
Joyce
Race Track
Water Tanks
Oil Tanks
Ski Lift
Tp 20 R 19 W 6
Tp 19 R 18 W 6
KAML

Figure 39 : Sketch geology of the Iron Mask Complex Batholith
(after Kwong, 1988)

Magnetite Deposits in the Iron Mask Batholith

IRON MASK M1 MINFILE: 092I NE 010
TYPE: Magmatic NTS: 92I 009
Past Producer LAT: 50 40' LONG: 120 27'
Figure: 39

The first recorded activity on the Iron Mask Mine was in 1896. By that time 200 claims had been recorded in the area and some small scale development was underway.

The copper ore was localized in two areas. The first was along a shear zone between picrite and Iron Mask Hybrid diorite and the second was in sheared diorite which had weakly mineralized picrite segments. Magnetite is referred to as being gangue as well as being prominent in the " altered zone ". The mine operated from 1901 to 1928 and produced 182,494 tons of copper - gold ore. A small amount of ore came from the adjoining Erin mine which was under the same managment.

There has been no mining done on the property since closing in 1928. In the early 1950's, surface mapping and some diamond drilling was done. In the 1970's, geophysical exploration and diamond drilling was done on the Iron Mask claim and many surrounding properties but the results were not available.

GLEN IRON MINE M2 MINFILE: 092I NE 025
TYPE: Magmatic NTS: 092I 10
Past Producer LAT: 120 32' LONG: 50 37'
Figure: 39

The Glen Iron mine is located near the northwest end of the Iron Mask batholith. Locally, the mine host rock is a biotite pyroxene diorite (see Iron Mask description). This is most probably the Pothook diorite.

Mineralization on the property consists of massive magnetite - apatite veins and tabular pods. Apatite is generally found only in the larger magnetite bodies. The apatite occurs as local concentrations of euhedral crystals, often up to several centimetres in length. The magnetite is otherwise free from impurities. In 1918, an assay from an 8 foot (2.4 m.) section on the open cut gave the following values : iron = 61 percent , silica = 1.50 percent , sulphur = trace (MMAR, 1918, pp. K237). The veins of magnetite vary in size with widths varing from 1 foot to 35 feet (0.3 to 11 m.) traced at surface for up to 650 feet (198 m.). The smaller, narrow veins are sinuous and pinch and swell over their length whereas the larger veins tend to be more tabular in outline. The largest exposed vein that was mined is 650 feet (198 m.) long and varies from 10 to 20 feet (3 to 6 m.) wide. Along the margin of the mined vein, a wide envelope of epidote altered host rock exists. Epidote alteration is not as prevalent along the other, smaller veins. Some tremolite or serpentine is found locally within the epidote alteration envelope. (Cockfield, 1948, pp. 133 - 4)

The first report of the property was in 1877 by G.M. Dawson of the Geological Survey of Canada. Shipments of ore began shortly after 1899 for flux in copper smelting processes and ceased in 1902. During production, 15,000 tons (13,607 tonnes) of high grade ore were shipped (Young and Uglow, 1926). Mining was by surface trenching on the largest magnetite vein. The trench is 450 feet (137 m.) long and 10 to 20 feet (3 to 6 m.) wide with a maximum depth of 40 feet (12 m.). At the lower end of the trench an adit was driven into the ore body. The adit is 150 feet (46

m.) long and shows ore for most of its length. About mid - length of the open cut, the adit passes 140 feet (43 m.) below. Ore is vertically continuous between both locations. An estimate of ore reserves of 175,000 tons (158,757 tonnes) probable and 325,000 tons (294,834 tonnes) total possible in the deposit was made by Young and Uglow (1926). More recent mapping and study of the batholith as a whole suggest the possible reserves could be greater. (R.M. Cann, 1979)

MAGNET, ANVIL, MOOSE M3 MINFILE: 92I NE 022
TYPE: Magmatic NTS: 92I 10
A Prospect LAT: 50 39' LONG: 120 29'
Figure: 39

The Magnet, Anvil, and Moose claim groups are located 12 kilometres west of Kamloops and are just east of the Afton mine site. Showings cover an east - west rectangle about three kilometres long and one and a half kilometres wide. The mineralization consists of magnetite magmatically injected into basic rocks at the northwest end of the Iron Mask batholith.

The Magnet showings are the western most of the group and are by far the best developed. Mineralization consists of two large , continuous veins of massive magnetite, the No. 3 and No. 4 veins, as well as several smaller ones. Veins consist of massive crystalline magnetite hosted in the Pothook transitional unit. Large apatite crystals, up to 3 centimetres long, and amphibole crystals, up to 6 centimetres long, form in zones parallel to the vein walls. Apatite occurs in all the lodes but amphibole is only present in some of the lodes. Ilmenite is found in very small quantities, sporadically dispersed throughout the magnetite. Chalcopyrite and pyrite are found within fractures and open spaces in the magnetite bodies (Cann, 1979). An assay of magnetite from one of the major veins yielded 55.2 percent iron, 3.7 percent insolubles, trace sulphur, 3.0 percent phosphorous, and 3.3 percent lime (Young and Uglow, 1926)

Both of the main veins strike southeast and dip steeply to the southwest and are traceable along strike for up to 1400 feet (427 m.). The larger No. 3 vein is greater than 10 feet (3 m.) wide and over a 200 foot (61 m.) length varies from 15 to 20 feet (4 - 6 m.) in width. The No. 4 vein has a maximum width of 30 feet (10 m.) but is commonly 8 feet (2 m.) wide. Several other veins parallel the major lodes but extend for a maximum of 100 feet (30 m.) along strike and vary from a few inches to a few feet wide (Young and Uglow, 1926). There appear to be no reports of proven depth beyond surface pitting .

The Anvil showings are about 800 metres southeast of the Magnet group. The metallic mineralization is similar to the Magnet veins but the host rocks are in large part Cherry Creek phase (Cann, 1979). The outcrops of magnetite are exposed over an area 1000 feet (305 m.) by 300 feet (91 m.)(Cockfield, 1948). Individual outcrops are scattered and the veins seen vary in size from 1 to 3 feet (< 1 m.) in width. The strike length of the veins is unknown. Structural information is lacking but the exposed veins are assumed to represent several mineralized zones.

The Moose claim group is 2000 feet (610 m.) northeast of the Anvil showings. Again, the metallic mineralization is the same as the Magnet showings. Host rocks are of the Pothook transitional unit. Several veins of magnetite that strike east - west and dip at 45 degrees to the south are exposed. Individual veins range from 1 to 5 feet (< 2 m.) in width and often form anastamosing zones of veinlets that rejoin into a single vein. Outcrop information indicates that there are many magnetite veins and they may represent a substantial extent of mineralization. (Cockfield, 1948 ; Young and Uglow, 1926)

COPPER KING M4 MINFILE: 92I NE 024
TYPE: Magmatic NTS: 92I 11
B Prospect LAT: 56 24' LONG: 120 40'
Figure: 39

The Copper King deposit occurs in a small outlier of Cherry Creek phase intrusive, northwest of the main Iron Mask complex. The old workings are just northwest of the Trans - Canada highway, at Cherry Bluff, 20 kilometres west of Kamloops.

The principal metallic minerals are chalcopyrite, pyrite, bornite, and magnetite. Sulphide mineralization occurs as disseminations within fractured Cherry Creek diorite. The sulphides appear to be primary (hypogene) mineralization from the stock itself. Fractures and joints form a zone about 30 feet (9 m.) wide and more than 130 feet (40 m.) long (Hedley, 1939). Magnetite, representing an earlier phase of mineralization than the sulphides, is found in small veinlets and stringers which strike 020 degrees and dip 70 to 90 degrees southeast. Occasionally, small amounts of chalcopyrite are found in the magnetite (Cockfield, 1948).

Development of the property began prior to 1906, at which time a small amount of hand picked of ore was shipped. Work continued sporadically through to 1940. A total of 7,491 tons (6,796 tonnes) of ore were shipped (Cockfield, 1948, pp. 109) assaying 3 percent copper and 0.14 oz. per ton (4.8 gm. per tonne) gold (MMAR, 1956, pp. 48). The property has been prospected intermittently since the close of the mine, with the last reported activity in 1972.

RAINBOW M5 MINFILE: 92I NE 028
TYPE: Magmatic NTS: 92I 09
Showing LAT: 50 38' LONG: 120 27'
Figure: 39

The Rainbow claim group is located on Sugarloaf hill, about 10 kilometres west - southwest of Kamloops. The property has been prospected over the years for copper. Mineralization hosted, in rocks of the Sugarloaf microdiorite unit appears to be controlled in part by a fracture zone which is oriented 030/70 SE (Cockfield, 1948). The ore consists of disseminations and stringers of chalcopyrite and pyrite with some associated molybdenum and silver. Magnetite appears as small stringers but no size or frequency is reported. The metallic mineralization extends along strike for several hundred metres, at least 400 feet (122 m.) of depth and several hundred feet in width (Property Maps, 1974). During the 1970's and early 1980's extensive drill exploration of the property was done. 10 million tons (9 million tonnes) of 0.58 percent copper ore has been delineated with no values for magnetite reported (BCMEMPR Preliminary Map 65, 1986).

EVENING STAR M6 MINFILE: 92I NE 007
TYPE: Magmatic NTS: 92I 09
Showing LAT: 50 37' LONG: 120 25'
Figure: 39

The Evening Star claims are located on the east slopes of Iron Hill and adjoin the south side of the old Iron Mask property. The claims have been extensively explored since the turn of the century. The main interest of the work has been for copper so magnetite is only mentioned in passing.

Mineralization is hosted in a remnant of Nicola group metavolcanics trapped between several phases of Iron Mask Intrusions. The Cherry Creek microdiorite, Iron Mask diorite, and Pothook transitional unit are all represented as fault slivers. Intrusive rocks are moderately albitized and chlorite altered and Nicola basalt tuffs are partly serpentinized and talc altered. The whole sequence is contained in a large shear and fault zone. East - west shear zones are truncated by major northwest faults. Two " master faults ", 500 to 600 feet (150 - 180 m.) apart bound the width of alteration and mineralization, but the strike length is open and not determined (MMAR, 1967 ; anon., 1974, map).

Metallic mineralization consists of chalcopyrite, magnetite, pyrite, and small amounts of gold. Stringers and disseminations of chalcopyrite are associated with nodules of magnetite and abundant pyrite. The metabasalts are irregularily mineralized and the intrusives appear barren. A magnetometer study of the property in 1965 determined that the magnetite lenses are locallized, shallow and do not continue to great depth. (Nicholls, 1965)

Exploration began at the site in 1897 and continued through to near 1920. The only report of production is in 1916 - 17 when 53 tons (48 tonnes) of ore were shipped. (MMAR, 1956, pp. 57). Detailed exploration of the site continued through the 1950's to the mid 1960's by Galaxy Minerals Ltd.. Further work on the property continued for the next several years but the results were not published. The extent of magnetite mineralization has never been specified in the published reports.

MONTE CARLO M7 MINFILE: 92I NE 014
TYPE: Magmatic NTS: 92I 09
Showing LAT: 50 36' LONG: 120 22'
Figure: 39

The Monte Carlo Crown Granted mineral claim is about 5 kilometres southwest of the old Iron Mask mine and 2 kilometres east of Jacko lake. The host rocks to mineralization are Iron Mask Hybrid unit to the north, Sugarloaf microdiorite, Nicola metavolcanics and picrite basalt to the south. The general trend of the rocks is east - west. Nicola group metavolcanics represent an included raft of country rock as all the other units are intrusive phases.

All of the intrusive phases show some degree of albitization and epidotization with more mafic phases appearing to have the greatest amount of alteration. Some quartz - calcite veining is associated with chalcopyrite mineralization . The magnetite may be hydrothermally remobilized form the surrounding rock and concentrated into veins in the altered rocks. (MMAR, 1956, pp. 64) Magnetite is most prevalent in chloritized shear zones, that on the property, trend east - west and dip steeply to the south. Pre - ore faults are considered to be important controls to ore mineralization (ibid.).

Metallic minerals are primarilly disseminations of pyrite and chalcopyrite in albitized Sugarloaf microdiorite. Magnetite is present as disseminations but is most prevalent in the shear zones. The other more mafic rocks do not show major metallic mineralization. The magnetite content is variable but veins up to 6 inches (15 cm.) wide have been reported (ibid.).

This property was also explored for its copper content. Assay values range from 3 percent to 0.35 percent copper (MMAR, 1956). Drilling in 1968 for Pinnacle mines Ltd. delineated 10 million tons (9 million tonnes) of 0.58 percent copper reserves with no values for magnetite reported. (Pendergast, 1969).

WHEAL TAMAR M8 MINFILE: 92I NE 013
TYPE: Magmatic NTS: 92I 09
Showing LAT: 50 37' LONG: 120 23'
Figure: 39

The Wheal Tamar Crown Granted mineral claim lies immediately west and adjacent to the Monte Carlo Crown Grant. Copper and magnetite mineralization occurs in an altered zone of Iron Mask intrusive. The host rock is altered Sugarloaf microdiorite, altered Hybrid unit and brecciated intrusive. Albitization varies from moderate to intense throughout the area and epidote occurs as disseminations and veinlets. The alteration is most intense around a fault oriented 315/ 80 NE.

Metallic minerals are limited to pyrite, chalcopyrite, and magnetite, although some bornite has been reported (Cockfield, 1948). The chalcopyrite occurs as disseminations and small veinlets, knife thin to 12 inches (30 cm.) wide and may or may not be associated with pyrite (ibid.). Magnetite is reported but its occurrence and abundance are not specified. All the sulphides are restricted to the altered host rock.

Exploration began at the turn of the century and continued for 10 to 15 years. During that time a shaft and several drifts were made. There are no reports of production. Since then, only some work done in the 1950's has been reported. The main thrust of exploration has been for copper and the magnetite content always has been ignored.

IRON CAP M9 MINFILE: 92I NE 018
TYPE: Magmatic NTS: 92I 09
Showing LAT: 50 39' LONG: 120 27'
Figure: 39

The Iron Cap claim lies just to the southwest of Iron Mask lake, 11 kilometres west of Kamloops. Previous work on the property was directed towards copper and some unusually high gold grades. Some small production has been reported near the turn of the century but none since then.

Host rocks are altered Cherry Creek diorite. Nicola group volcanics lie to the north and diorite, either the Pothook Transitional or Iron Mask Hybrid unit (author note), lie to the south. Most of the host Cherry Creek unit is substantially albitized, making it look like a monzonite (MMAR, 1956). Alteration is most intense next to faults which transect the property. These strike east - west or northwest - southeast and have steep or vertical dips.

Mineralization consists of chalcopyrite, pyrite, magnetite and gold. The gold is restricted to the fracture zones. Magnetite is ubiquitous throughout the property. Induced polarization and magnetometer surveys indicate that magnetite may represent 2 to 6 percent of the total rock volume (Property Report, 1965). Magnetite veins cut the host rock and are not associated with the sulphide mineralization (Cockfield, 1948). Size and frequency of the magnetite veins are not specified.

A total of 263 tons (238 tonnes) of picked ore were shipped in 1938 and 1940. (MMAR, 1956, pp.68 ; Cockfield, 1948, pp. 110) Some geophysical surveys were done on the property in the mid 1960's but little else has been reported.

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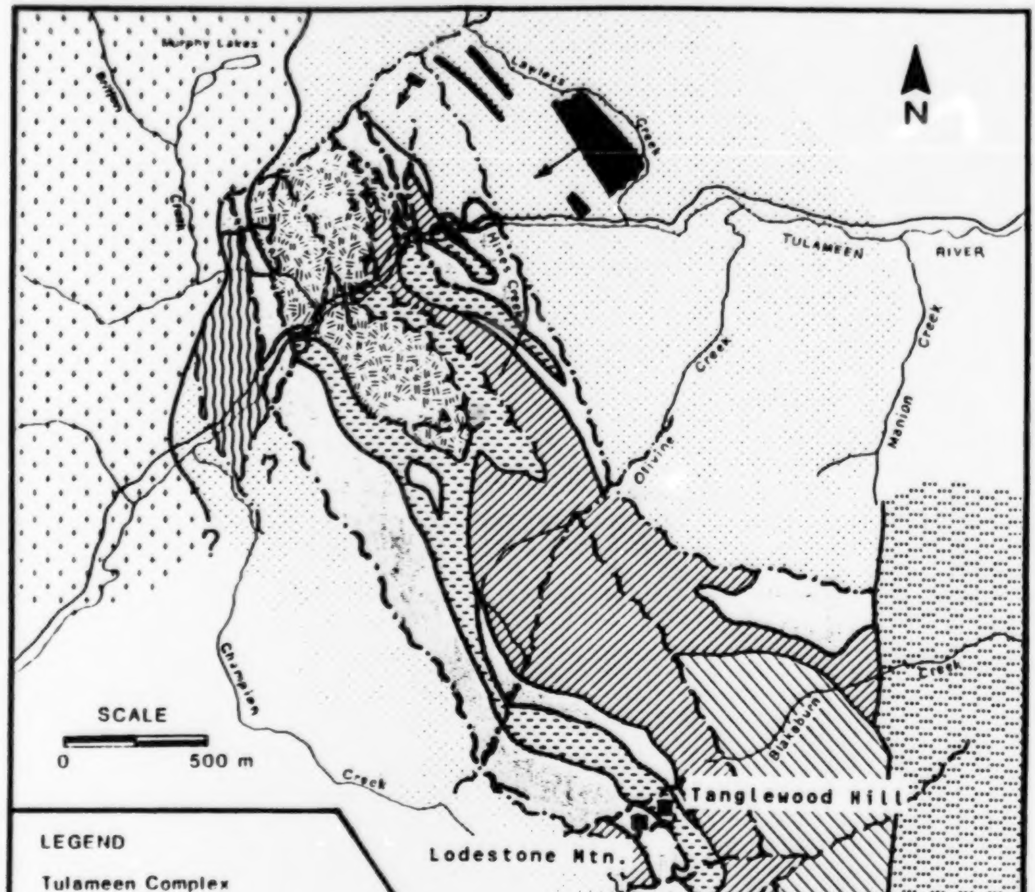
Murphy Lakes
Britton Creek
Lawless Creek
N
Hines Creek
TULAMEEN RIVER
Olivine Creek
Manion Creek
?
?
Champion Creek
SCALE
0
500 m
Tanglewood Hill
Lodestone Mtn.
Blakeburn Creek
Newton Creek
Badger Creek
Creek
Arrastra Creek
Granite Creek
LEGEND
Tulameen Complex
Dunite
Syenogabbro
Syenodiorite
Olivine Clinopyroxenite
Hornblende Clinopyroxenite
Mylonitic Rocks (undifferentiated Nicola/ultramafic rocks)
Eagle granodiorite
Princeton Group
Nicola Group (showing volcanic units)
Stratigraphic top
Fault defined, inferred
Thrust fault defined, inferred

Figure 40 : Sketch geology of the Tulameen Ultramafic Complex (after Nixon, 1988)

ULTRAMAFIC ASSOCIATED MAGNETITE DEPOSITS

TULAMEEN ULTRAMAFIC COMPLEX

The Tulameen ultramafic complex lies 23 kilometres due west of Princeton, British Columbia. The complex is an Alaskan - type zoned ultramafite. This complex has been the source of most of the platinum production of this province. As well, it has been the site of lode chromium and iron ore exploration since the turn of the century.

The Tulameen ultramafite is an elongate body, 17 kilometres in length and varying in width from 2.5 to 6.5 kilometres, that is oriented along a northwest trend. The host rocks to the intrusive are andesitic metavolcanics and metasediments of the Triassic Nicola Group, locally metamorphosed from greenschist to amphibolite grade. To the northwest and north, Eagle granodiorite of the Mount Lytton complex truncates the northern margin.

The Tulameen complex has a dunite core mantled by pyroxenites and surrounded by a marginal gabbro phase. It is unusual compared to Alaskan complexes in that the mafic rocks are syenogabbros and syenodiorites rather than tholeiitic basalts (Findlay, 1969). The dunite core is composed of olivine with interstitial chromite. The platinum of the complex appears concentrated in discontinuous chromite layers. Olivine is variably serpentinized and often small, less than 1 cm., asbestoform serpentine joint and fracture fillings web the core. Peripheral to the core is an olivine clinopyroxenite zone. This unit is comprised of olivine and bright green diopside. In contrast with the core, this rock is much less serpentinized, generally less than 20 percent altered. Surrounding this is a hornblende clinopyroxenite unit of the intrusion that is composed of diopsidic augite, hornblende, and magnetite with minor amounts of biotite, apatite, and vermiculite. Syenogabbro is located at the southern and southeastern end of the complex. The primary mineralogy is plagioclase (andesine) , clinopyroxene, hornblende, potassium feldspar, with minor amounts of apatite and sphene.

The whole complex has been cut by northwest trending transcurrent faults associated with the Fraser River - Straight Creek fault system (Rublee, 1988 ; Monger, 1985). Several strike - slip faults cut the ultramafic complex along a northwest trend and northeast - southwest extensional faults transect the complex. All of the contacts of the intrusive with the Nicola group host rocks appear to be high angle faults or ductile shear zones, possibly grading to mylonite zones. (Nixon, 1987)

The magnetite deposits are essentially confined to the hornblende clinopyroxenite phase of the intrusive. The most significant exposures of magnetite are on Lodestone Mountain and Tanglewood Hill in the central part of the complex. The character of the magnetite ranges from disseminations to large, almost completely massive lenses. It appears that with increasing amounts of massive magnetite the amount of disseminated magnetite decreases (MMAR, 1959).

MAGNETITE OCCURRENCES IN THE TULAMEEN ULTRAMAFIC COMPLEX

LODESTONE MOUNTAIN U1 MINFILE: 92H SE 034
TYPE: Ultramafic Assoc. NTS: 92H 07
A Prospect LAT: 49 28' LONG: 120 52'
Figure: 40

Lodestone Mountain is 23 kilometres due west of Princeton, B.C. and 8 kilometres south of the Tulameen River. Magnetite is hosted in the hornblende clinopyroxenite phase of the Tulameen ultramafic complex and occurs as disseminations, blebs and small veins. The greatest concentration of mineralization appears along the ridge axis of the mountain and down the northeast slope.

On Lodestone Mountain the magnetite is found as disseminations and as veins averaging one inch (2.5 cm.) wide and three to four feet (<= 1 m.) long. The largest reported pod is two feet (61 cm.) wide and six feet (180 cm.) long (MMAR, 1959). Several assays of magnetite rich rocks yielded a range of 13.03 to 22.32 percent iron and 0.28 to 1.08 percent titanium. An assay of high grade ore from an old trench graded 49.03 percent iron and 1.98 percent titanium (MMAR, 1959, pp. 50 & 51). A large portion of magnetite mineralization appears to be along the ridge axis and down the northeast side of Lodestone Mountain.

Historically, Lodestone Mountain has seen sporadic iron ore exploration since the turn of the century. Development has not been extensive, restricted to a few trenches until the 1950's. Work by the Imperial Metals and Power Ltd. from 1956 to 1959 delineated a major zone of magnetite mineralization extending 2,200 feet (671 m.) northwest, greater than 900 feet (275 m.) wide and at least 350 (107 m.) deep with 12 to 24 percent acid soluble iron (Lindley, 1962). Further work at the same time indicated 25 million tons (22.7 Megatonnes) of magnetite ore with 18 percent total recovery for a total of 4.5 million tons (4.1 Megatonnes) of iron (Lea, 1962). Later exploration in the mid 1970's, by the Cleavland Cliffs Iron Company, estimated a total of 91,171,000 tons (83 Megatonnes) of 17.3 percent recoverable iron (Financial Post, 1978, pp. 186). Work on Lodestone Mountain has been relatively continuous for the last ten years. Most recently, Tiffany Resources has been working at the site.

TANGLEWOOD HILL U2 MINFILE: 92H SE 035
TYPE: Ultramafic Assoc. NTS: 92H 07
A Prospect LAT: 49 28' LONG: 120 52'
Figure: 40

Tanglewood Hill lies immediately east of Lodestone Mountain. The two locations have often been worked together during iron ore exploration. Tanglewood Hill is noted as having more concentrations of massive magnetite than Lodestone Mountain but the overall grades of mineralization are almost equivalent (MMAR, 1959).

Tanglewood Hill has historically shown the greatest concentrations of magnetite in the area. Magnetite is hosted in the hornblende clinopyroxenite unit of the ultramafic complex. The magnetite is found as blebs and lenses. The blebs commonly range from one to five pounds (1/2 to 2 1/2 kg.). Lenses vary from 1 inch to 18 feet (2 cm. to 5 1/2 m.)

wide but are normally 2 to 4 feet (60 to 180 cm.) wide; the lengths are not well known due to the poor exposure (MMAR, 1959). The largest lens known is 300 feet (91 m.) long , 10 feet (3 m.) wide and is estimated to have 60,000 tons (54,430 tonnes) of ore (ibid.). Most of the lenses trend west to northwest and dip steeply to the south. Assay values of the magnetite at Tanglewood Hill are the same as those for Lodestone Mountain.

D, R, TULAMEEN U3 MINFILE: 92H NE 128
TYPE: Ultramafic Assoc. NTS: 92H 10
Showing LAT: 49 31' LONG: 120 53'
Figure: 40

The D and R claims lie on the south flank of Grasshopper Mountain, above the confluence of Britton Creek and the Tulameen River. These claims have been previously known as the Grasshopper Mountain chromite deposits (Rice, 1947). Host rocks are those of the Tulameen complex core dunite. Locally the host appears to be an oval breccia pipe (MMAR, 1972). Chromite and magnetite occur as disseminations and occasional local blebs within the olivine matrix. Assays of metal - rich samples have yielded platinum grades as high as 0.35 oz. per ton (12 gm. per tonne) (Rice, 1947). However, the continuity of mineralization has not been established. Also reported to occur at the site are chalcopyrite, millerite, sperrylite and asbestos. A small amount of trenching was done in 1972 but the results were " not encouraging ". (MMAR, 1972)

OTHER ULTRAMAFIC ASSOCIATED MAGNETITE OCCURRENCES

CASSIAR ASBESTOS MINE U4 MINFILE: 104P 005
Type: Serpentenite Assoc. NTS: 104P 05
A Prospect LAT: 59 19' LONG: 129 49'
Figure: 41

The Cassiar open pit mine is 5 kilometres north of the town of Cassiar. The mine produces asbestos of several grades and is world reknowned for its long fibre asbestos. The deposit is a serpentenized ultramafite with crysotile vein fillings. The magnetite is an associated retrograde metamorphic product.

Serpentinite is hosted in clastic and volcanic rocks of the Devono - Mississippian Sylvester Group. The strata are composed of chert, argillite, argillaceous quartzite, greenstone and greywackes. The sequence trends north northwest and dips moderately to the northeast. Regionally the rocks are part of the western limb of a large synclinorium. To the west of the deposit is the Juro - Cretaceous granodiorite Cassiar batholith. The serpentinized ultramafite was intruded semicoformably into the host strata. The original composition of the ultramafite is postulated to have been an hartzburgite. The resultant form is an elongate body that trends northwest and dips to the northeast. The body is approximately 1,700 feet (518 m.) long and is a maximum of 500 feet (152 m.) wide. Several smaller pods of serpentine are found to the northwest. A large associated body is exposed 1,200 feet (366 m.) to the north of the main body. The showing is similar in occurrence and mineralogy to the main serpentinite.(Gabrielse, 1963, pp. 123 - 126)

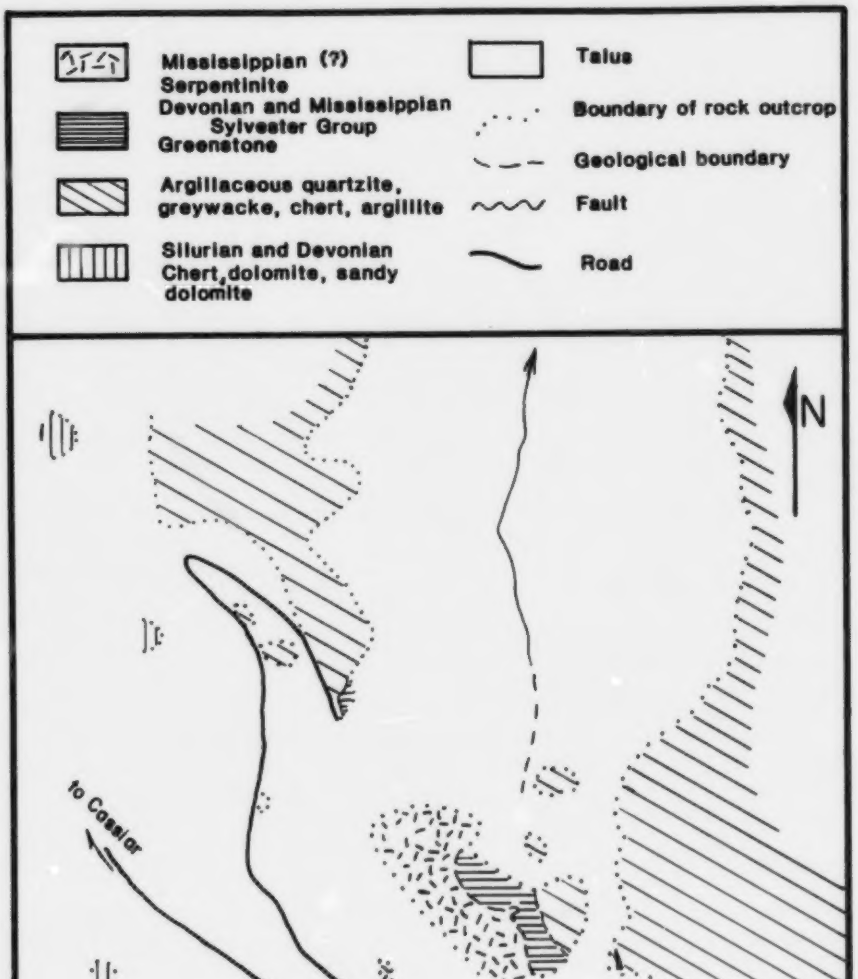
Mississippian (?)
Serpentinite
Devonian and Mississippian
Sylvester Group
Greenstone
Argillaceous quartzite, greywacke, chert, argillite
Silurian and Devonian
Chert, dolomite, sandy dolomite
Talus
Boundary of rock outcrop
Geological boundary
Fault
Road
N
to Cassiar
0 200 400
Feet

Figure 41 : Sketch geology of the Cassiar Asbestos deposit (after Gabrielse, 1951)

Immediately adjacent to the serpentenite is a gradational margin into a chlorite - antigorite alteration envelope. Outside of the aureole, the Sylvester Group rocks are hornfelsed and grade away into less metamorphosed rock. The majority of the serpentine is antigortie. The asbestoform crysotile is restricted to a complex series of joint and fracture fillings that web the body. (Gabrielse, 1963, pp. 123 - 126)

Mineralization of the Cassiar deposit is crysotile serpentine. This asbestos is restricted to a complex series of fractures and joints caused by multiple phases of deformation in the region. Two significant phases of deformation with associated mineralization have been determined (O'Hanley, 1987). The first phase has associated magnetite mineralization. The magnetite occurs as finely disseminated grains along the fracture walls or as entrained grains within the asbestos fibres. Also, a small proportion of the magnetite occurs as microveins in the antigorite serpentine. (ibid.) The magnetite bearing asbestos veins and the microveins are crosscut by magnetite free, phase two asbestos veins.

Internal studies of magnetite content by Cassiar Asbestos Ltd. during 1986, have shown that the magnetite content varies from 3.2 to 23.7 percent of the ore with an average magnetite content of 9 percent. (R. Tyne, pers. comm.) At present the magnetite is magnetically separated from the asbestos fibre and is discarded with the mill waste. There has been no attempted recovery of the magnetite in the past.

The original discovery of asbestos in the Mt. McDame area dates back to 1941. Production has continued from 1953 to the present day and is still active. The mine is working from the main serpentine body. In 1987, the company began a major exploration program to develop the large McDame underground deposit at the mine site.

SKARN U5 MINFILE: 103G 039
TYPE: Ultramafic Assoc. NTS: 103G 08
Showing LAT: 53 27' LONG: 130 00'

The Skarn showing is on the northeast side of Banks Island, 100 kilometres south of Prince Rupert. The initial interest in the area was for gold bearing skarns in a limestone unit. It was later, during reconnaisance mapping that an iron - titanium - vanadium bearing gabbro unit was recognised. The gabbro is intrudes metasediments, metavolcanics and gneissic granitoid rocks. Regional structures have significantly deformed the sequence.

The gabbro unit is highly magnetic and is composed of hornblende, pyroxene, and plagioclase. Hornblende is often found in crystal clusters several inches across. Plagioclase crystals are coarse grained and are often as large as one inch across. The intrusive is a long, narrow (< 1 1/2 km.) mass that extends at least 1,700 feet (518 m.) along strike (McDougall, 1985). Regional deformation has foliated the body along a northwest trend with steep easterly dips. Northwest striking slip faults and splays transect the gabbro unit. Chloritization and epidotization are common along and near the faults. Contacts with the host rocks are variable from intrusive contacts to shear zones. The northeast margin of the gabbro is bounded by marble and skarn lenses and the southwest margin is terminated by a quartz diorite intrusion, similar to others of the Coast Plutonic Complex. Along the northwest margin, a wide migmatitic zone separates the gabbro from a diorite unit. It is along the migmatitic zone that the highest vanadium concentrations are found.

Metallic mineralization of the gabbro consists of disseminations and bands of titaniferous magnetite and some associated vanadium. The bands of magnetite follow the regional northwest structural trend. The largest zone found is a banded sequence, 100 to 200 feet (30 to 60 m.) wide and 1000 feet (305 m.) long. Both sides are flanked by low grade, disseminated magnetite. A general rock sample assayed 20 to 25 percent iron, 1.1 to 1.9 percent titanium, and 0.04 to 0.33 percent vanadium. Assays of magnetic concentrate yielded greater than 50 percent iron, 1.5 to 5.0 percent titanium, and 0.5 to 1.0 percent vanadium. (Rose, 1973) The titanium and vanadium are carried in solid solution with the magnetite. It has been reported that " Several million tons (tonnes) of low grade iron - titanium - vanadium bearing material are known at this locality. " (Rose, 1973).

MH U6 MINFILE: 104G 026
TYPE: Ultramafic Assoc. NTS: 104G 13
Showing LAT: 57 51' LONG: 131 43'

The MH showing is located on Shakes Creek, 32 kilometres southwest of Telegraph Creek. The showings are in a gabbro stock thickly mantled by glacial overburden. Exploration has been restricted to geophysical methods and a small amount of trenching.

The Shakes Creek ultramafic stock intrudes Permian or Triassic volcanics which have been metamorphosed to greenschist facies. The intrusive is an oval body 17,000 feet (5185 m.) long and 7,500 feet (2,288 m.) wide along a north - south trend (McIntyre, 1966). The body is a fine to medium grained crystalline mass of clinopyroxene and plagioclase with some olivine. Associated with the intrusion are some small syenite bodies. Locally, small fractures cut the body and show minor epidote and chlorite alteration.

Mineralization, essentially restricted to titaniferous magnetite, is found as interstitial disseminations or scattered veinlets up to two inches (5 cm.) wide. Assays of the gabbro yielded an average of 65 percent total iron with 11 percent magnetic iron (McIntyre, 1966). Reported exploration ceased when no precious metals were found. Due to the extremely limited exposure, only a small portion of the stock could be examined in detail (MMAR, 1965 ; 1966).

SUL, WT U7 MINFILE: 104I 076
TYPE: Ultramafic Assoc. NTS: 104I 07
Showing LAT: 58 18' LONG: 128 36'

The SUL claim group is 4.5 kilometres south - southwest of Wolverine Lake in the Cassiar Mountains. Reports on this property are very brief. Mineralization appears to be massive magnetite and chalcopyrite in a fine grained peridotite dyke. Size, continuity, and grade of mineralization are not specified. (GEM, 1975 ; 1977)

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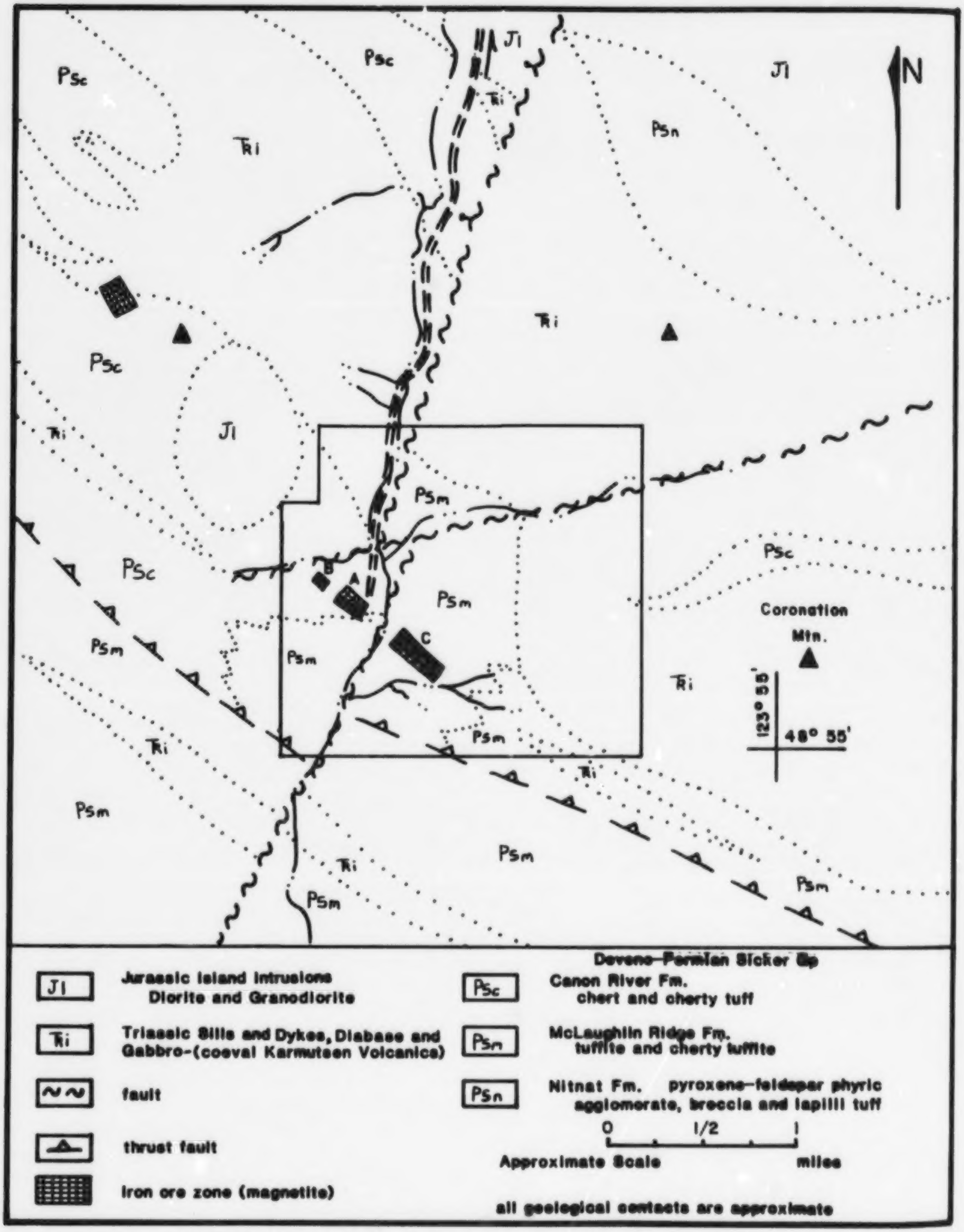
Psc
Psc
Ji
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Tri
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Tri
Psc
Ji
Tri
Psm
Psc
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A
Psm
Psc
Coronation Mtn.
Psm
Psm
C
Tri
123° 55'
48° 55'
Psm
Tri
Tri
Psm
Psm
Tri
Psm
Psm
Ji
Jurassic Island Intrusions
Diorite and Granodiorite
Tri
Triassic Sills and Dykes, Diabase and Gabbro-(coeval Karmutsen Volcanics)
fault
thrust fault
iron ore zone (magnetite)
Devono–Permian Sicker Gp
Psc
Canon River Fm.
chert and cherty tuff
Psm
McLaughlin Ridge Fm.
tuffite and cherty tuffite
Psn
Nitnat Fm. pyroxene–feldspar phyric
agglomerate, breccia and lapilli tuff
0
1/2
1
Approximate Scale
miles
all geological contacts are approximate

Figure 42 : Sketch geology of the Lady A iron deposit
(after Massey et. al., 1988 and Ladysmith Development Cp., 1953)

STRATABOUND MAGNETITE DEPOSITS

BANDED IRON FORMATIONS

Banded iron formations (BIF's) are of two types; the Algoma type, Archean volcanogenic BIF's and the Superior type, early Proterozoic sedimentary - exhalative BIF's.

The Superior BIF's are often massive to pulverent layers of pure hematite at surface. At depth the bodies are taconites, interlayered sequences composed of magnetite, iron silicates and chert with rare hematite and siderite. In outcrop the taconites are thinly bedded layers of black magnetite and red hematitic jasper with some white layers of chert. Layers and beds of clastic material are often interfingered with the iron rich beds. The deposits were laid down over a long period of time during the Proterozoic by sedimentary - exhalative (Sedex) processes. The deposits are significant because of their immense areal extent as the original basins in which the BIF's formed were of the order of 750 to 1000 km in diameter.

The Algoma type banded iron formations are closely associated with volcanogenic processes. The ore horizons consist of magnetite, hematite, and chert similar to the Superior type formations. However, the ore horizons tend to be thinner and the host rocks for the Algoma type BIF's are volcanic flows and volcaniclastics. Algoma BIF's deposits were formed during the Archean and represent some of the oldest mineral deposits in the world.

The author has recognised several magnetite showings in British Columbia which appear to be or are reported as being BIF's.

Superior Type BIF's

LADY A, B, C St 1
TYPE: Taconite BIF
A Prospect
Figure: 42

MINFILE: 92B 029
NTS 92B 13
LAT: 48 55' LONG: 123 56'

The Lady A showings lie 13 kilometres southwest of Ladysmith, across Chipman (Boulder) Creek. Iron taconites occur in three zones hosted in Mississippian age Sicker Group sediments. Exploration on the property was brief and directed entirely for iron ore.

Host rocks are cherty slates of the upper Sicker Group. Locally the rocks are folded into an open syncline trending east southeast. Bedding at the site strikes southeast and dips steeply to the north. Magnetite is found in large lenses of jasperoid slates that are conformable with bedding. Mineralization consists of finely disseminated magnetite in grey chert and hematite in red jasper. The small amount of hematite in the rocks gives the jasper its red colour.

Mineralization occupies three discrete zones. The "A" zone outcrops over an area 360 feet (110 m.) by 60 feet (18 m.), the "B" zone outcrops 100 feet (30 m.) by 25 feet (8 m.), and the "C" zone outcrops 175 feet (53 m.) by 50 feet (15 m.) (MMAR, 1959, pp. 135; Buckham, 1953). The "C" zone is the largest body, estimated to have

2,366,900 long tons (2.4 megatonnes) grading 18.24 percent iron. The "A" zone is estimated to have 360,000 long tons (0.37 megatonnes) with a grade of 25.16 percent iron. The "B" zone is considered inconsequential so the total size of the deposit is 2,727,170 long tons (2.8 megatonnes) with an average grade of 19.15 percent iron (Buckham, 1953).

The only work done on the property was a drill program in 1953 by the Ladysmith Development Ltd.. No other work has been reported on the claims.

MESABI, EVB St 2 MINFILE: 92B 030
TYPE: Taconite BIF NTS: 92B 13
B Prospect LAT: 48 46' LONG: 123 32'

The EVB claims lie on the west slope of Mount Sullivan, north of Musgrave, Salt Spring Island. The magnetite occurrence is an iron taconite in the upper Sicker Group sediments.

Host rocks are schists adjacent to Sicker volcanics. Magnetite is associated with lenses of chert and jasper, conformable with the bedding and cleavage in the schists. Both bedding and cleavage strike east - west and dip steeply to the south.

Magnetite occurs as very fine disseminations within the chert and jasper. Lenses in which magnetite is present are up to 150 feet (46 m.) long and 20 feet (6 m.) wide (MMAR, 1918, pp. K300). The zone of mineralization is about 100 feet (30 m.) wide and over 500 feet (152 m.) long. Assays of the taconite have yielded iron contents from 39.5 to 5.96 percent (MMAR 1918; 1956, pp. 136).

COTTONBELT St 3 MINFILE: 82M 086
TYPE: BIF NTS: 82M 07 / 10
B Prospect LAT: 51 26' LONG: 118 48'

The Cottonbelt claim lies on the southwest slope of Mount Grace, 64 kilometres northwest of Revelstoke. This is one of six original claims which are located on the Cottonbelt stratabound lead - zinc - iron layer. This body lies within gneisses in the Shuswap Metamorphic Complex.

Host rocks are gneisses and schists metamorphosed to amphibolite grade and tightly folded by the Mount Grace syncline. The host succession is a complex layered sequence comprising a basement of orthogneiss and paragneiss overlain by a basal quartzite and pelitic schists which host a stratiform carbonatite called the Mount Grace carbonatite. They are overlain by a thick succession of calc - silicate gneiss and impure marble which, near the top, host the Cottonbelt sulphide - magnetite layer. Capping the whole sequence is a section of interlayered sillimanite schists, quartz - feldspar gneiss, and quartzite. The gneiss which hosts the sulphide - magnetite layer is composed of Mn - olivine (knebelite), actinolite, diopside, and Mn - pyroxene. The footwall gneiss is quite calcareous and the hangingwall gneiss is more pelitic. (Hoy, 1987)

The Mount Grace syncline is a large, early fold that is draped around the northern portion of Frenchman Cap Dome. The syncline is recumbent, isoclinal, and plunges southeast. Both limbs are present and continuous across the southwest slopes of Mount Grace. The upper limb is overturned which causes a structural repetition of the mineralized layer. (Hoy, 1987; MMAR, 1922, pp. N150).

Metallic minerals present are galena, sphalerite, magnetite, and minor pyrrhotite. All of these minerals are medium to coarse grained and are either intimately intermixed or occur as individual massive zones. Mineralization extends for 600 metres along strike with further extentions of disseminated pyrrhotite, averaging one to two metres thick in the upright lower limb and about three metres thick in the inyerted upper limb. An estimate of geological reserves report 750,000 tonnes in place with grades of 6 percent lead, 5 percent zinc, and 50 gm / tonne gold (Hoy, 1987). No estimates of magnetite content are reported as in the past it has been considered an accessory mineral.

Exploration of the area began at the turn of the century for base metals. The property remained idle until 1970 when Great Northern Petroleums and Mines did surface mapping, trenching and reconditioned an adit (GEM, 1970). The following major work at the site was a drill project by Metallgeschaft, Canada Ltd. in 1978. Since then there are no reports of activity.

FALCON	St 4	MINFILE:	930 016
TYPE: Taconite BIF		NTS:	930 11
B Prospect		LAT: 55 42'	LONG: 123 20'

The Falcon claim group is located 40 kilometres northwest of Mackenzie. The claims cover a large area in the Misinchinka Range. The deposit is a large Precambrian taconite iron formation.

Host rocks to the deposit are a clastic - carbonate - clastic sequence of the Hadrynian Misinchinka Formation (GEM, 1979, pp. 239). The upper and lower clastic units both contain iron mineralization. However the upper unit contains the majority of the iron. Both units are schistose argillites and greywackes that contain jasperoid cherts in typical taconite style. Pronounced colour banding is present throughout the body.

The host rocks have been extensively folded and deformed. All structures show prominent eastward vergence. Locally the sequence has been folded into a tight anticline. Parasitic folds have created a ten fold thickening of the mineralized horizon in the fold nose. Both limbs thin rapidly away from the nose. The anticline plunges at 20 degrees and strikes 110 to 130 degrees but some shallow northwest plunges have been reported. A strong axial plane cleavage is present, oriented at 110 - 130 / 60 - 80 southwest. Crossing the body at depth is a thrust fault oriented 140 / 15 southwest that has a maximum displacement of several hundred metres (Brownlee and Coombes, 1986).

Mineralization consists of magnetite, with some hematite, in two horizons. Each horizon is magnetically inferred to be 100 to 300 feet (30 to 92 m.) wide and have been traced along strike 1170 metres on the property with an extention in excess of 8300 feet (2530 m.) to the southeast. The mineralized zone dips steeply to the southwest, again magnetically inferred (Sharp, 1976). There is great potential for strike length extention as the host formation extends for more than 10 kilometres (Brownlee and Coombes, 1986). The depth potential is limited to the structurally thickened nose of the anticline.

Reserve figures have been reported as follows:

Upper Fm.	BIF facies	3.51 million tons	38.7 % Fe-t
		(3.18 MT)	30.1 % Fe-m
	Silica facies	4.29 million tons	29.3 % Fe-t
		(3.89 MT)	15.6 % Fe-m
Lower Fm.		2.01 million tons	36.4 % Fe-t
		(1.82 MT)	23.2 % Fe-m

note: Fe-t = total iron ; Fe-m = magnetic iron ; MT = Megatonnes.
(Brownlee and Coombes, 1986)

This deposit has been likened to taconite BIF's of the Abitibi (Superior) type (ibid.). These are Precambrian low grade taconites of very large areal extent.

SPARKLE St 5 MINFILE: 82M 207
TYPE: Taconite BIF NTS: 82M 03
Showing LAT: 59 01' LONG: 119 26'

The Sparkle claims are located on Scotch Creek, 83 kilometres due west of Revelstoke. They are part of a larger series of claims including the Metal Crest Crown Grant. Primary interest in the area is for gold, lead, and zinc in rocks adjacent to the Shuswap Metamorphic Complex. Magnetite is found in taconites within the Paleozoic Eagle Bay Formation.

Host rocks at the Sparkle claims are primarily chloritic phyllites and argillites. Within this area, chert units carry the magnetite. The phyllite package is chlorite rich, black, strongly folded, and contains variable amounts of crenulated argillites. Conglomerates, sandstones, and some limestone are interfingered with the phyllites. All of these rocks have been metamorphosed to greenschist facies. The southwest side of the Sparkle claims are underlain by a quartz - feldspar augen gneiss. A portion of the Scotch Creek quartz monzonite stock occurs to the northwest of the property.

Folding and faulting are significant in all the rocks. Four phases of deformation have been recognized at the site. The first two phases developed a north northeast trending penetrative cleavage subparallel to bedding and folds. A third phase created folds along west northwest axes and steep northeast dipping axial planar cleavage and the fourth phase consists of fractures and kink folding with northerly trends. Transecting the property is the Scotch Creek fault which has a northerly strike and a nearly vertical dip.

Mineralization consists of two types: a late phase consisting of quartz - carbonate veining with silver, lead, and zinc and an early phase of magnetite in bedding parallel chert lenses contained in argillites. The lenses are long and thin but can be up to five metres wide. One lens was traced for 35 metres at surface and it is known to extend under the drift cover. Magnetite is the primary metallic mineral in the taconite zones. (Neale and Hawkins, 1985) Due to the base metal exploration target, iron content and extent are not specified. However it is stated that magnetite is a significant secondary mineral (ibid.).

In the late 1920's, work on the Metal Crest quartz carbonate veins had commenced. Then in 1984, Van Win Resources did surface exploration on the Sparkle and other claims. There are no further reports of activity.

VOLCANOGENIC MAGNETITE DEPOSITS

Algoma Type BIF's

GRANDUC MINE St 6 MINFILE: 104B 021
TYPE: Volcanogenic NTS: 104B 08
A Prospect LAT: 56 13' LONG: 130 20'
Figure: 43

The Granduc Mine was a significant producer of copper from 1970 to 1984. The mine site lies 46 kilometres northwest of Stewart. The orebody has been classified as a volcanogenic massive sulphide deposit with a substantial amount of associated magnetite but the presence of large quantities of magnetite is unusual for this genetic deposit type.

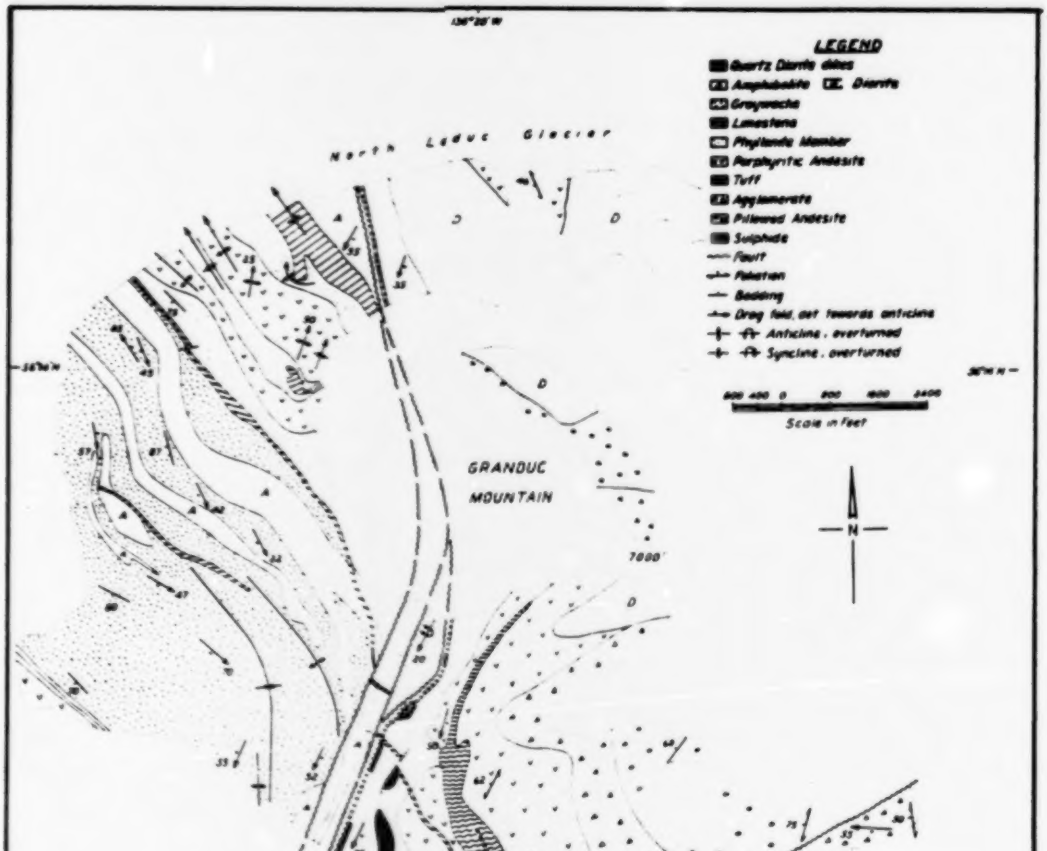
The ore mineralization is hosted in a package of metasediments within an upper Triassic (Karnian) volcanic pile. (Norman and McCue, 1966). The bedded rocks are shallow water greywackes, siltstones, conglomerates, tuffs, cherts and limestones. A thick succession of mafic pillow basalts underlies these sedimentary rocks and another package of mafic volcanics overlies the host sequence. A granodiorite intrusion of the Coast Plutonic Complex lies south of the deposit. Diorite to granodiorite dykes form swarms throughout the mine area. Regional metamorphism has altered the host rocks to greenschist facies.

Host rocks have been extensively deformed. Tectonic breccias and mylonite zones are common in the ore zone. All deformation postdates the mineralization but there has been some remobilization of ore minerals during deformation. The deposit is intricately folded into drag folds of a large north trending anticline that tips the strata almost on edge. The deposit is in the west limb. Bedding strikes north and dips steeply to the west. The complex structural distortion and thermal alteration has lead to some mineral recrystallization.

Spatially, the ore occupied a large vertical and lateral extent. The stratigraphic interval was about 120 metres wide, 750 metres high, and 1200 metres long. Within the stratigraphic interval, ore was locallized into seven major lenses, each several hundred metres in lateral extent (Grove, 1986). These were composed of massive chalcopyrite, galena, and sphalerite. As well, ore occured as thick beds between thin beds of host rock.

Magnetite is ubiquitous throughout the deposit. In the ore zones magnetite is found as disseminations and thin beds. Between the ore zones magnetite occurs as thick, bedding parallel lenses. During mining, head grades averaged 12 percent iron and Kirkham (1979) has described the body as an iron deposit with associated copper.

The amount of magnetite with the massive sulphides indicates an unusual genesis. The spatial relationship of the magnetite and sulphides indicates a rhythmically alternating deposition of metallic minerals. The depositional enviroment had to be predominantly within the oxide marine enviroment to account for the ubiquitous magnetite. The presence of sulphides indicates that a reducing enviroment occurred from time to time. Possibly the deposit was at such a depth that minor fluctuations in the sulphur and oxygen fugacities allowed deposition of both mineral types.


136°05'W
LEGEND
Quartz Diorite dikes
Amphibolite
Diorite
Graywacke
Limestone
Phyllonite Member
Porphyritic Andesite
Tuff
Agglomerate
Pillowed Andesite
Sulphide
Fault
Foliation
Bedding
Drag fold, axt towards anticline
Anticline, overturned
Syncline, overturned
800 400 0 800 1600 2400
Scale in Feet
N
North Leduc Glacier
GRANDUC MOUNTAIN
7000'
3100'
South Fault
Western Fault
Granduc Fault
Central Fault
Leduc Glacier
D
A

GEOLOGY AND STRUCTURE OF GRANDUC MOUNTAIN
SULPHIDE BODIES SHOWN IN DIAGRAMMATIC PROJECTION

Figure 43 : Sketch geology of the Granduc deposit
(after Norman and McCue, 1966)

The association of metallic minerals, tuffs and chemical sediments indicate that the body was formed by seafloor volcanic and sedimentary processes, ie. a syngenetic volcanogenic model. (Grove, 1986) The depositional enviroment, oxide and sulphide mineralogy and deposit form are consistant with an Algoma type BIF genetic model (submarine volcanogenic BIF).

The Granduc discovery claims were located in 1951 when ablation of the South Leduc glacier uncovered several mineralized outcrops. The area was subsequently prospected in detail and by 1961, underground exploration began. 1968 saw the completion of an 11.6 mile (18.7 km.) tunnel from Tide Lake to the proposed mine site and mining and milling commenced in 1970. The original reserves were estimated at 49 million tonnes of 1.55 percent copper and 6.9 gm. / tonne silver ore. Unfortunately the predicted ore grade and continuity was not achieved during mining. Coupled with high capital costs and high operating costs, the mine closed in 1978. The mine was reopened in 1980 and worked until 1984. Again, high costs and low copper prices caused the mine to close. A total of 9.89 million tonnes of ore were mined with an average grade of 1.79 percent copper and minor gold and silver (BCMEMPR, 1986, Preliminary Map 65). Substantial low grade copper reserves remain in place. (Alldrick, D., Pers. Comm.). Magnetite from the copper ore was discarded with the mill tailings.

METAMORPHIC HOST MAGNETITE DEPOSITS

HAIL. HARPER CREEK St 7 MINFILE: 82M 009
TYPE: Metamorphic Host NTS: 82M 12
B Prospect LAT: 51 31' LONG: 119 49'

The Hail claim group is situated nine kilometres southwest of Vavenby, on Harper Creek. Exploration began in 1966 when Noranda Exploration Ltd. followed up on some regional geochemical copper anomalies.

Host rocks to the mineralization are a series of pelitic and carbonate rocks in the Eagle Bay Formation metamorphosed to sub-greenschist and greenschist facies. Specifically they are fine grained phyllitic greenschist, fine grained graphitic marble and impure limestone, grey phyllite, and fine grained sericitic quartzite.

The rocks have a well developed foliation which strikes east-northeast and dips gently to the north. To the northwest of the claim group, the rocks are deformed into nearly recumbent, sub-isoclinal folds that plunge gently to the northwest. Vertical fractures associated with small scale kink folding strike north - south and are found throughout the area. Some sulphide mineralization is found along the fractures. (GEM, 1970, pp. 301)

The total area of mineralization is about 6000 feet (1830 m.) by 4000 feet (1220 m.) (MMAR, 1970). However, the most significant mineralization is in the quartz sericite schist and the dark grey phyllite. Chalcopyrite, the primary mineral, occurs as fracture fillings and disseminations in the host. Pyrite, pyrrhotite, and magnetite are the next most abundant minerals. Magnetite is found as lenses and sheets throughout the schist and phyllite. Several large lenses of magnetite, exceeding 12 feet (4 m.) in thickness, have been found. A magnetometer survey indicated a 1500 by 1800 foot (458 by 549 metres) zone probably due to substantial magnetite mineralization (Stollery, 1968). Subsequent work has not expanded on the magnetite mineralization but 90 million tons (81.6 Megatonnes) of 0.4 percent copper mineralization have been delineated (Schiarizza, 1985).

STAR, RUPERT St 8 MINFILE: 103J 035
TYPE: Metamorphic Host NTS: 103J 01
B Prospect LAT: 54 03' LONG: 130 19'

The Star and Rupert claims lie on the northeast shore of Porcher Island at Chismore Passage, 27 kilometres south of Prince Rupert. Magnetite is hosted in metamorphic rocks of the Prince Rupert Formation. Mineralization extends along the coast and the claims cover the most prominent showings.

Magnetite occurs in a horizon of dark grey pelitic schist. The unit strikes northwest and dips 60 to 70 degrees to the northeast. Epidote and chlorite are common in the schist and small amounts of biotite and garnet occur throughout. The schist is often very siliceous. Schistosity is bedding parallel and both follow the regional structural trends.

Magnetite occurs as discontinuous lenses and sheets that parallel the schistosity. The maximum width of mineralization is about 200 feet (181 m.) but it extends along strike in excess of 13,000 feet (3965 m.) (Young and Uglow, 1926, pp. 21 - 24 ; MMAR, 1956, pp. 128). Drilling in 1956 indicated that mineralization extends beyond 150 feet (46 m.) in depth. Individual lenses are often up to 12 feet (4 m.) wide and several sections are more than twice as wide. However, the mineralized zone commonly consists of a series of thin sheets tens of feet wide and extending more than 100 feet (30 m.) along strike (ibid.). Drilling on two of the major showings has indicated reserves of several hundred thousand tons (tonnes) averaging 35 percent iron (MMAR, 1956, pp. 129).

KUMEOLEON St 9 MINFILE: 103H 004
TYPE: Metamorphic Host NTS: 103H 13
Showing LAT: 53 51' LONG: 129 58'

The Kumeoleon showings are on Kumeoleon Inlet at the north end of Grenville Channel. The host rocks are intercalated limestones and schists of the Prince Rupert Formation metamorphosed to amphibolite grade. Sillimanite, cordierite, and orthopyroxene are present in the schists. Of particular note is the presence of emery. This is an amalgam of magnetite and corundum that is commonly used as an abrasive. An assay of emery bearing rock yielded 30 percent silica, 35 percent magnetic iron oxide, 30 percent alumina, and 1.2 percent lime (MMAR, 1929, pp. C74). Ilmenite is also present in the rock. Reports on the property do not specify the extent or distribution of magnetite mineralization.

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Black Sands in British Columbia

Black sands are ubiquitious in any placer deposit. The largest heavy mineral deposits in British Columbia are on the offshore banks between northern Vancouver Island and Dixon Entrance. The greatest concentrations of black sand beach placer deposits are on the northeast shores of Graham Island, the main northern island of the Queen Charlotte archipellago. Black sand beaches extend from Tlell, north to Rose Point, east to Entrance Point, then south past Masset .

Beach deposits follow the coastal margin of the Argonaut Plain of Graham Island. The plain consists primarily of Pleistocene unconsolidated marine and glacial sediments and recent overburden. The source of the sands along the east coast of Graham Island is a large offshore shelf which extends from Rose Point to Prince Rupert to Skidgate Inlet. The most prominent heavy minerals are hematite, magnetite, titano-magnetite, ilmenite, garnet, with some gold and platinum. These minerals are relics from the erosion of the surrounding mountains, most significantly the Coast Mountains. Southeasterly gales work up bottom sediments from the shelf and transport them northwards along the east coast by longshore drift. Storm waves rework the beaches and concentrate the heavy minerals along the strand forming the modern beach placers. (Donaldson, 1957 ; Samson, 1984).

These beach deposits are characteristically long, thin, sinuous bodies of high grade concentrations interspersed in low grade sands and gravels. The high grade strips are commonly up to 12 inches (30 cm.) thick, 10 to 15 feet (3.0 - 4.5 m.) wide and 50 feet (15 m.) to one mile (1,600 m.) long (Robertson and Russel, 1956). The total average grade of the sands is 10.5 percent heavy minerals with high grade sands up to 80 percent heavy minerals; a typical composition of the heavies is 25 percent magnetite, 25 percent titaniferous hematite, 6 percent ilmenite, 2 percent zircon, 0.1 percent rutile, 41.7 percent garnet and altered silicates (Donaldson, 1957). Intervening sands carry up to 3 percent heavies of similar composition but much greater volume. The deposits are generally less than 20 feet (6 m.) deep as they bottom on glacial clays or till.

The black sands of Masset are quite different from those of the east coast. These sands are in old stream and beach facies which extend back 500 feet (150 m.) from the existing shoreline. The heavy minerals are paleo-placers, the result of glacial ice moving across Graham Island and subsequent isostatic rebound. Heavy mineral strips are less well delineated than those of the east coast but they are known to be shallower. The high grade lenses are up to one foot (30 cm.) thick, 20 feet (6 m.) wide and up to one half mile (152 m.) long and grade up to 15 percent heavy minerals. A single, high grade sample yielded 80 percent heavy minerals which assayed 23.9 percent magnetite, 38.8 percent hematite, and 15.1 percent garnet and staurolite. (Donaldson, 1957 ; Samson, 1984) All of the reports on the black sands record the presence of gold and rare platinum.

Historical production from the beach sands has been placer gold and were short lived due to the difficulty of fine gold recovery. Total production of gold is 715 troy ounces (22.2 kg.) (Samson, 1984). The placer operations worked sporadically from the turn of the century to the late 1940's. The main areas of interest were Fife Point, Rose Point, Oeanda River, and Masset Inlet.

In 1956 and 1957 the Mogul Mining Corp. did an extensive drill evaluation of 48 kilometres of beach deposits on Graham Island. The results of the testing indicated 30 million tons (27 Megatonnes) of black sand to a depth of 20 feet (6 m.), averaging 10.56 percent total heavy minerals and 2.6 percent magnetite. A further 30 million tons (27 Megatonnes) is estimated to exist below the 20 foot (6 m.) level. The east Masset Inlet paleo - placer has an unspecified reserve tonnage grading 3.0 percent magnetite per ton. All the deposits have magnetite with high iron content, 69 percent Fe, and low titanium content, 1.0 percent (Davidson, 1957). The company abandoned the project due to low economic magnetite grade and poor gold recovery.

Today, a large park (Naikoon Park) covers the northeast portion of Graham Island and includes most of the beaches. The paleo - placer on Masset Inlet is not covered by the park.

Offshore Heavy Mineral Potential in Hecate Strait and Queen Charlotte Sound

There is a great potential for magnetite and other heavy minerals on the offshore banks east and south of the Queen Charlotte Islands. These are modern placer deposits of magnetite, titano - magnetite, ilmenite, and heavy silicates such as zircon and garnet.

The banks lie within 100 metres of the ocean surface. In Hecate Strait, a broad shelf extends across from the mainland to the Queen Charlotte archipelago. In The Queen Charlotte Sound, there are several banks between 30 and 120 metres deep separated by troughs up to 500 metres deep. The two major locations are the Cook and Goose Island Banks. (see figure 45)

The ocean bottom is locally underlain by Tertiary sediments of the Skonum Formation. The Quaternary sediments vary in thickness but can be over 100 metres thick. The source of the heavy minerals is eroded Quaternary and Tertiary sediments including the local Masset volcanics.

The heavy minerals form an average of 10 percent of the bottom sands. The Hecate Strait sands contain a maximum of 15 percent heavy minerals and the Queen Charlotte Sound sands contain a maximum of 25 percent heavy minerals. The heavy minerals are found primarily in the fine sands, 0.15 to 0.20 mm. in size (100 - 70 mesh ASTM appx.). The composition of the heavy mineral fraction is as follows :

30 - 50 percent	Amphibole
5 - 25 percent	Opaques , mostly ilmenite
5 - 15 percent	Sphene
> 5 percent	Garnet, Epidote, Magnetite and Titano - magnetite, Chlorite

The heavy minerals have been concentrated in `lag placers' through the transport of sediments by bottom currents generated during the most intense seasonal storms. Lag placers are created by the entrainment of lighter minerals in the bottom current flow and the more dense minerals are left, or lag, behind. The most significant concentrations occur at depths between 80 and 120 metres depth (44 - 66 fathoms). (Barrie et. al., 1988)

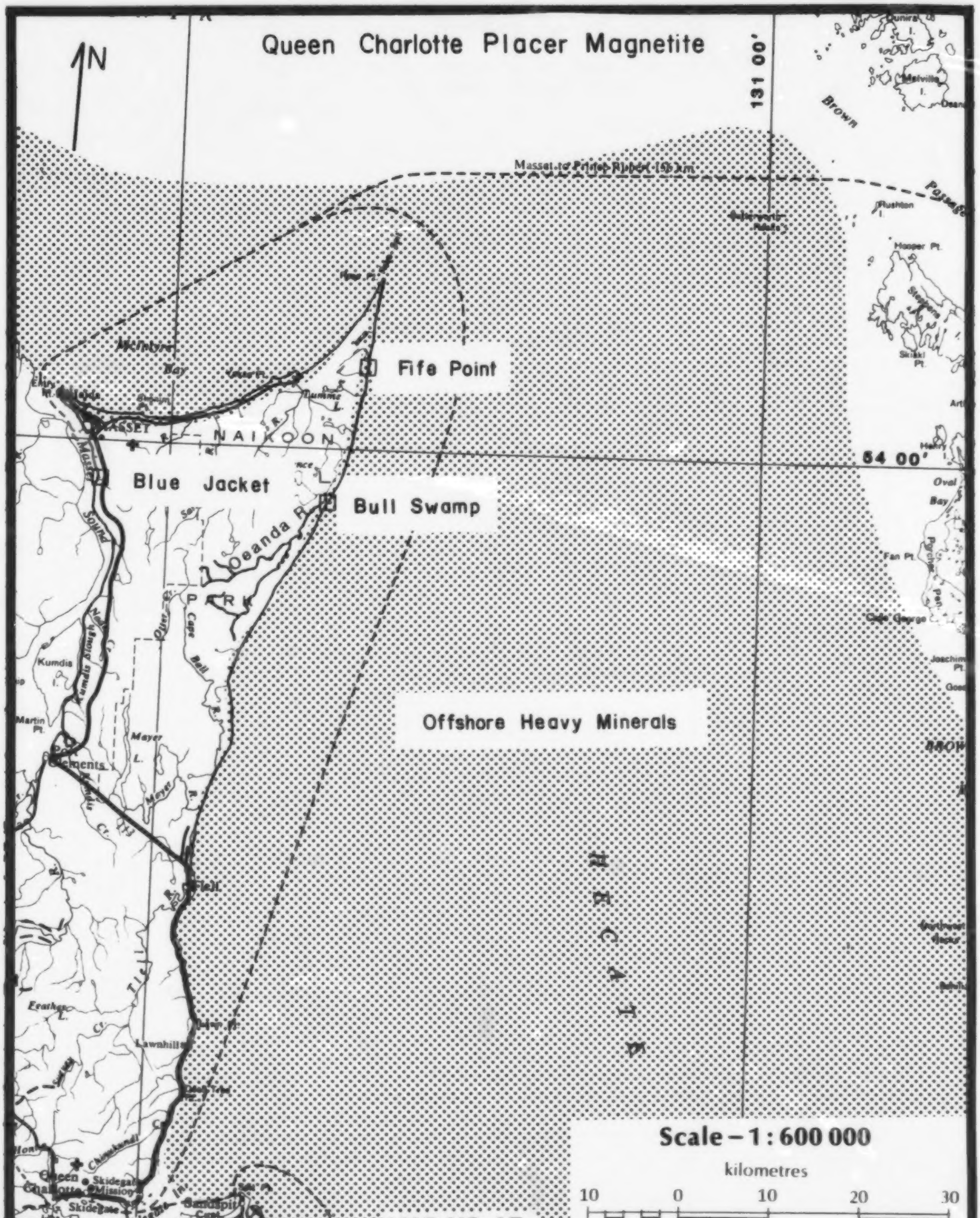

Queen Charlotte Placer Magnetite
N
131 00'
54 00'
Brown
Passage
Masset to Prince Rupert 150 km
Fife Point
Blue Jacket
Bull Swamp
NAIKOON
PARK
MASSET
Masset Sound
Oeanda R.
McIntyre Bay
Kumdis
Martin Pt.
Port Clements
Mayer L.
Tlell
Lawnhill
Queen Charlotte
Skidegate Mission
Skidegate Inlet
Sandspit
Offshore Heavy Minerals
HECATE
Dundas I.
Melville I.
Rushton I.
Hooper Pt.
Oval Bay
Fan Pt.
Cape George
Scale – 1 : 600 000
kilometres
10
0
10
20
30
MAP NO. 1F

Figure 44 : Location of the Queen Charlotte Islands beach placers

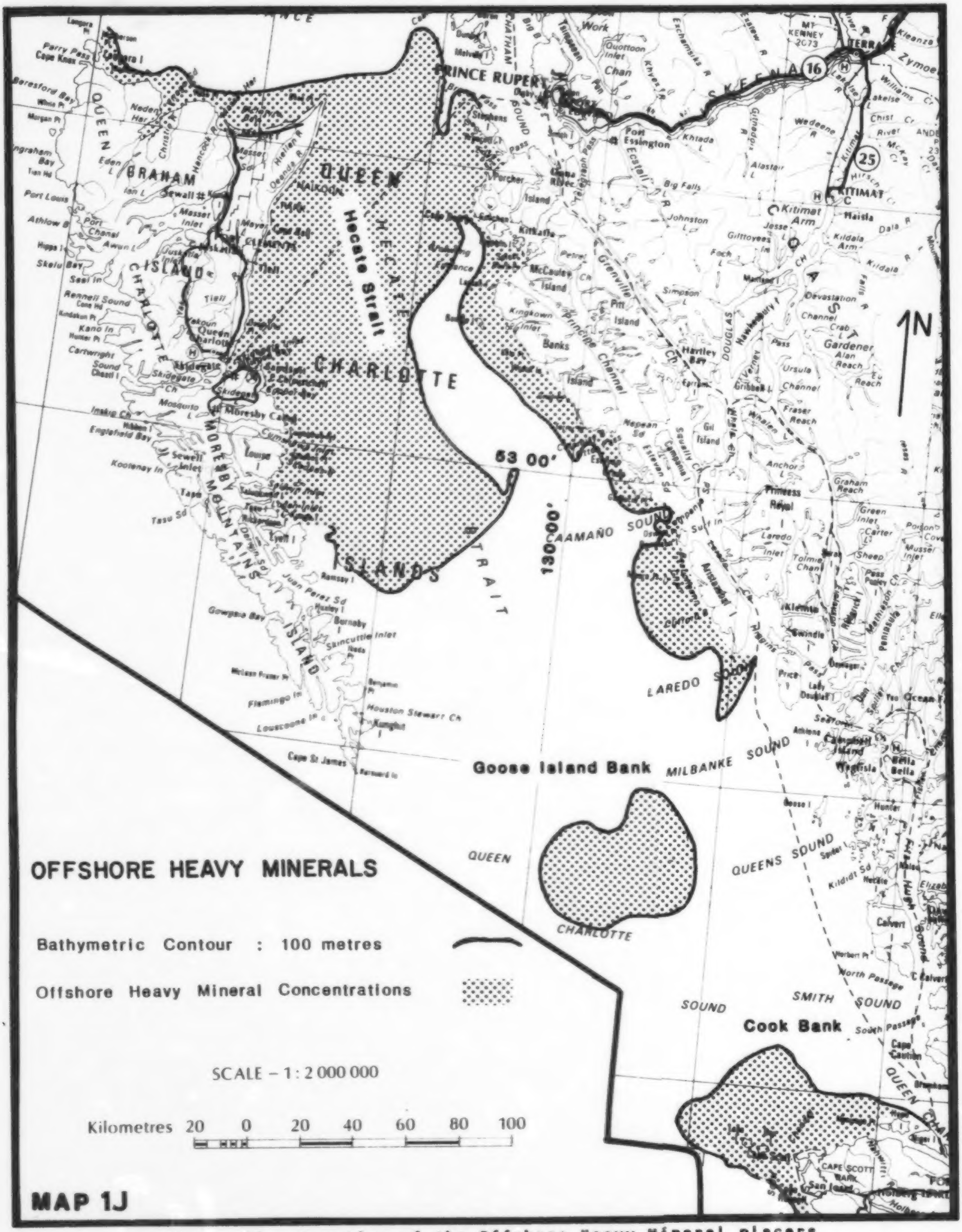

OFFSHORE HEAVY MINERALS
Bathymetric Contour : 100 metres
Offshore Heavy Mineral Concentrations
SCALE – 1: 2 000 000
Kilometres 20 0 20 40 60 80 100
MAP 1J
N
Hecate Strait
QUEEN CHARLOTTE ISLANDS
HECATE STRAIT
GRAHAM ISLAND
MORESBY ISLAND
MORESBY MOUNTAINS
53 00'
130 00'
CAAMAÑO SOUND
LAREDO SOUND
Goose Island Bank
MILBANKE SOUND
QUEENS SOUND
QUEEN CHARLOTTE SOUND
SMITH SOUND
Cook Bank
PRINCE RUPERT
TERRACE
KITIMAT
SKEENA
COAST
Princess Royal
Banks Island
Pitt Island
Bella Bella
Cape St James
16
25

Figure 45 : Location of the Offshore Heavy Mineral placers (after Barrie et. al., 1988)

Offshore placer deposits of heavy minerals have been developed elsewhere in the world. Titanium rich (ilmenite) sands are mined off the coasts of Sri Lanka and the Konkan coast of India. The potential of offshore titanium sands is presently being investigated on the continental shelf of Senegal and of Australia. The offshore placer deposits of Canada, British Columbia and Newfoundland, are still just being recognised. However the size and quality of mineralization as presently known indicates there is a great potential for heavy mineral production. (Barrie et. al., 1988)

BLACK SAND PLACERS ON GRAHAM ISLAND

BLUE JACKET P1 MINFILE: 103F 026
TYPE: PLACER NTS: 103F 16
B Prospect LAT: 53 59' LONG: 132 08'
Figure: 44

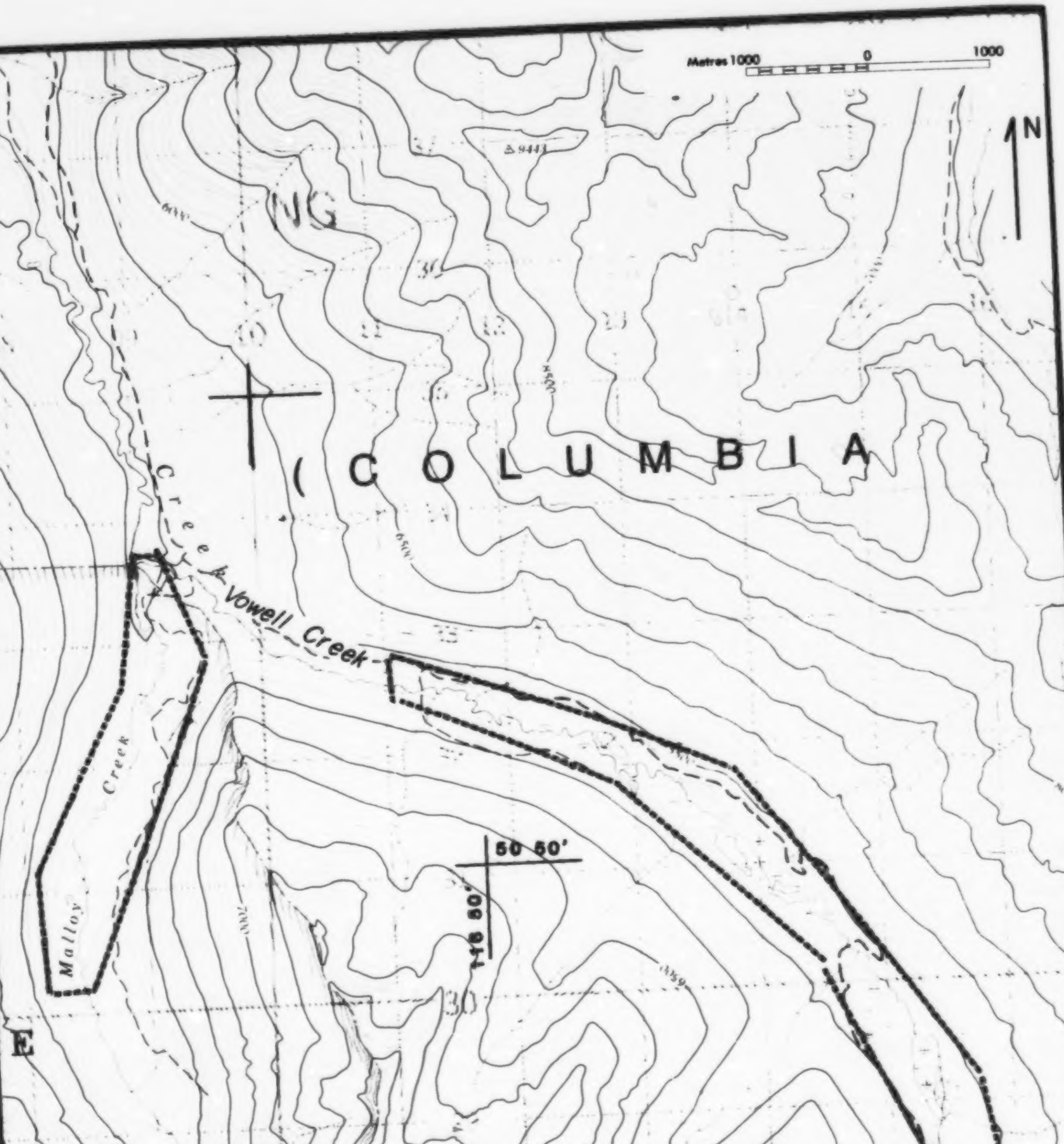
This deposit is about one mile (1.6 km.) south of Masset on the east side of Masset Inlet. The body is a paleo - placer unlike the modern placers of the north and east coasts of the island.The first reported activity on the property was in 1923 when a washing plant was being set up and the property has been worked sporadically since then. This includes a small amount of test pitting and washing but, due to the heavy bush, the workings are not extensive. Gold and platinum were reported but recoveries were poor. An assay from the Mogul Mining project reported gold at 0.05 oz. per ton (1.7 gm. per tonne) and magnetite at 3.0 percent of the total mass (Donaldson, 1957). A report from 1933 typifies the style of operation on the property, " ... from five to seven men have been earning small wages, or expenses, by sluicing concentration streaks in sands and gravel of a raised beach deposit ... " (MMAR, 1933, pp. A40). There has been no reported activity on the property since the 1957 Mogul Mining Corp. project.

BULL SWAMP , BLACK P2 MINFILE: 103G 001
TYPE: Placer NTS: 103G 13
B Prospect LAT: 53 59' LONG: 131 42'
Figure: 44

This property is situated near the mouth of the Oeanda River. The " Bull Swamp " region is a four mile (6.4 km.) stretch of beach centered on the mouth of the river. Several operators attempted to recover gold from 1906 to 1935 but met with little success as the large volume of black sands impaired conventional sluice recovery methods. Since then only the Mogul Mining Corp. has been reported to have done work on the property.

FIFE POINT P3 MINFILE: 103J 035
TYPE: Placer NTS: 103J 04
B Prospect LAT: 54 06' LONG: 131 40'
Figure: 44

This property is situated at Fife Point (Cape Fife), about five miles (8 km.) south of Rose Point. The property saw sporadic work from the turn of the century to the late thirties with only small quantities of gold recovered by conventional methods from the high grade strips in the beach sands. No data on the magnetite content of the sands is recorded. No Further work other than the Mogul Mining Corp. project has been reported for the property.


Metres 1000
0
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Δ9443
NG
(C O L U M B I A
Creek
Vowell Creek
Malloy
Creek
50 50'
116 50'
30
E
Vowell Peak
Osprey Peak
VOWELL CREEK & MALLOY CREEK MAGNETITE PLACERS
BUGABOO CREEK
82 K/15

Figure 46 : Location of the Vowell Creek placer deposits

FLUVIAL BLACK SAND PLACERS

VOWELL CREEK P4 MINFILE: 82K NE 007
TYPE: Placer NTS: 82K 15
B Prospect LAT: 50 50' LONG 116 47'
Figure: 46

Vowell Creek placer deposits, located northeast of the Horsethief batholith, have been tested for uranium bearing and rare earth minerals for several years. Glacial erosion and subsequent weathering of the Horsethief and Bugaboo porphyritic quartz monzonite batholiths have led to the concentration of heavy minerals in the upper reaches of the stream. The most significant minerals present are magnetite, ilmenite, uraniferous columbium, pyrochlore, euxenite, and uranothorite. The deposits are estimated to average 350 feet (105 m.) wide, 10 feet (3 m.) deep and 7000 feet (2100 m.) long (Hughes, 1954).

Drill testing in 1954 for the St. Eugene Mines Ltd. delineated 14 million yards (10.7 million cubic metres) of proven pay gravel with 0.19 lb. per yd. (113 gm. per cubic metre) Nb2O5. A total reserve figure estimates 65 million yards (49.7 million cubic metres) (proven, possible, probable) of gravel. Subsequent work in 1968 and 1969 has not reported volumes or grades. Magnetite quantities are not specified for the property but it is mentioned as being a significant portion of the black sands. There are no reports of activity on the property since 1975.

REFERENCES FOR PLACER MAGNETITE DEPOSITS

GRAHAM ISLAND

----- ; 1955 ; Black Sands: Queen Charlotte Islands ; for Quebec Metallurgical Industries Ltd., BCMEMPR Property File 103 J/4 , 103 G/13

Barrie, J.V., Emory - Moore, M., Luternauer, J.L. and Bornhold B.D. ; 1988 ; Origin of Modern Heavy Mineral Deposits, Northern British Columbia Continental Shelf ; in publication, Marine Geology

Donaldson, C.H. ; 1957 ; Report: Queen Charlotte Island Sands ; for Mogul Mining Corp. Ltd., BCMEMPR Property File 103 G,J,K

Minister of Mines, B.C. ; Annual Reports ; 1929, 1923, 1933

Robertson, J.A. and Russel, F.T. ; 1956 ; Report on Queen. Charlotte Island Black Sands ; BCMEMPR Property Files 103 G,J,K

Samson, J. ; 1984 ; An Overview of Coastal and Marine Gold Placer Occurrences in Nova Scotia and British Columbia ; Canada Oil and Gas, Lands Administration - Ocean Mining Division, Document 1984 - 3

VOWELL CREEK

Geology, Exploration and Mining in British Columbia ; 1969

Hughes, H.D. ; 1954 ; Winter Drilling - Bugaboo Placers ; BCMEMPR Property File 82K NE General

Minister of Mines, B.C. ; Annual Reports ; 1956, 1968

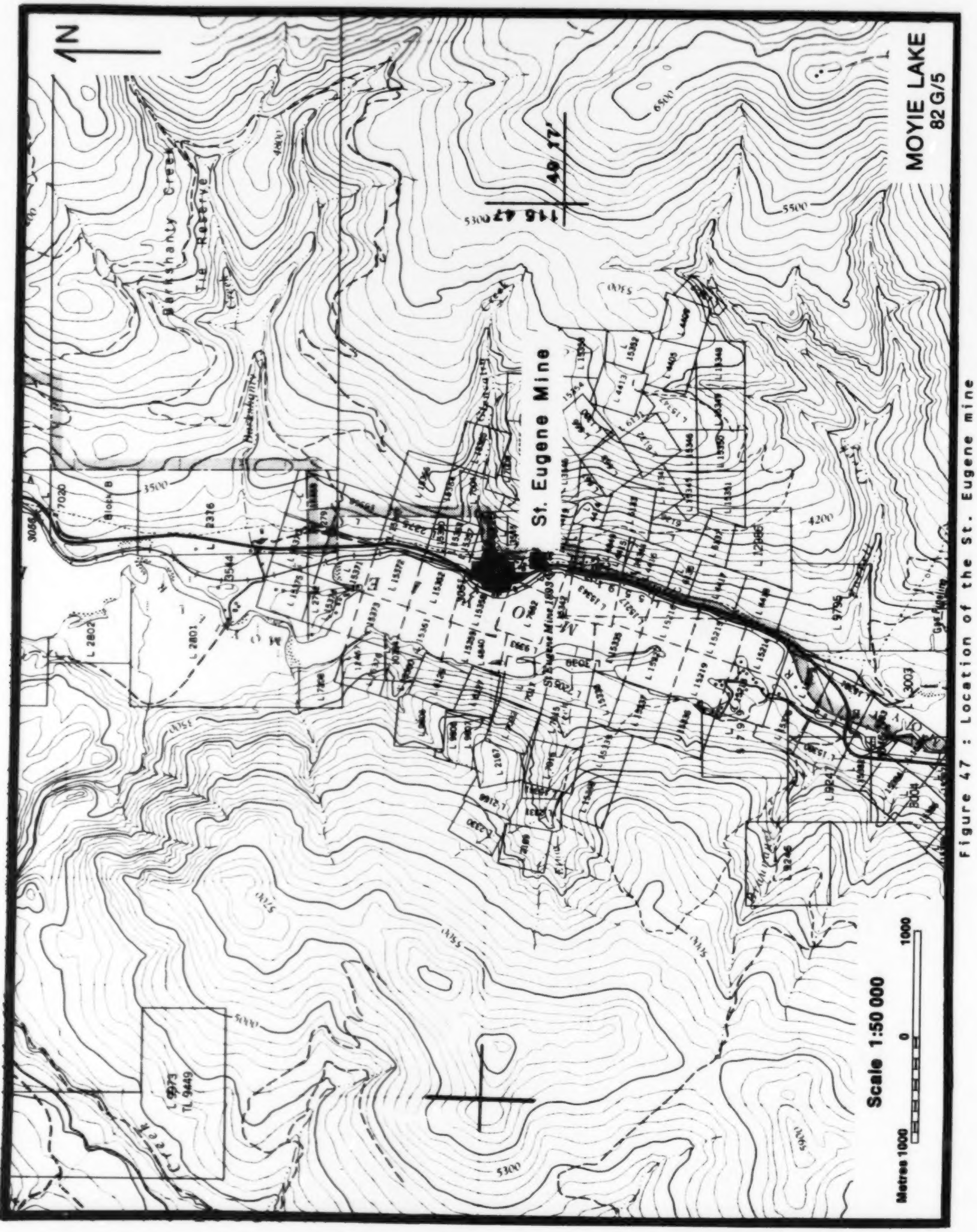
MOYIE LAKE
82 G/5
N
St. Eugene Mine
49 17'
116 47'
Scale 1:50 000
Metres 1000
0
1000
L 5973
TL 9449
Tie Reserve
Creek

Figure 47 : Location of the St. Eugene mine

VEIN ASSOCIATED MAGNETITE DEPOSITS

ST. EUGENE MINE V1

MINFILE: 82G SW 025
TYPE: Vein
NTS: 82G 005
A Prospect
LAT: 49 17' LONG: 115 49'
Figure: 47

The St. Eugene mine, located 30 kilometres south of Kimberly in southeastern B.C., was the first major producer of silver, lead, and zinc in the province. It operated for the first quarter of this century and at one time provided alternate ore milling for the Sullivan deposit.

The deposit is within quartzites of the Middle Aldridge Formation. Locally the formation consists of thin, 1 - 2 foot (30 - 60 cm.), interbedded argillaceous quartzites and siliceous argillites. The strata are folded into an open anticline which plunges gently to the north. The St. Eugene deposit is in the eastern limb of the anticline, locallized in two east - west fault zones. The faults dip steeply to the south, perpendicular to the axial plane of the fold. Displacements along the fault are small.

Minerallization consists of sphalerite, galena, magnetite, pyrite, and pyrrhotite in a gangue of garnet, actinolite, calcite, and quartz. Ore grade mineralization, at time of mining, was restricted to a few steeply plunging shoots in the plane of the faults.

The St. Eugene property was staked in 1892 by A.L. Hogg and was optioned by the Consolidated Mining and Smelting Co. in 1900. Development began directly with two adits driven on the best silver and lead showings. Shipping of ore concentrate began in 1900 and for several years following 1904, the St. Eugene mine was the largest producer of lead in the province. Major production continued until 1911 when the ore became uneconomical to mine, and from then until 1925 when the mine was shut down, only small scale mining continued. With the development of the Sullivan deposit, the mill and concentrator at the St. Eugene mine were upgraded and during the early 1920's processed some of the Sullivan ore. As well, old tailings and mine waste from the St. Eugene mine were processed in the mill from 1926 to 1929. At that time all waste had been processed for the total contained ore; silver, lead, zinc, and gold. The total ore mined for the period 1900 to 1929 was 1.63 million tons (1.48 megatonnes). Magnetite was discarded as waste or mill tailings and the proportion of magnetite in ore is not given.

Little work was done on the property until the 1960's when a small amount of diamond drilling and surface work was carried out from 1962 to 1966 including several deep holes, one of which was 3707 feet (1130 m.) deep. Since then, little or no work has been done on the property.

WINDPASS V2

MINFILE: 92P 039
TYPE: Vein
NTS: 92P 08
Showing
LAT: 51 26' LONG: 120 05'

The Windpass mine lies on the southwestern slopes of Mount Baldy, 30 kilometres north of Barrierre. The deposit is a vein complex with free gold and substantial accessory magnetite.

The deposit is hosted in volcanic and sedimentary rocks of the upper Paleozoic Fernell Formation (GEM, 1973, 273). The mineralization is associated with a large sill of diorite micropegmatite that is approximately 1600 metres wide and several kilometres long. The sill trends north and dips to the west. (Cooke, 1946)

The main vein strikes east, dips about 45 degrees to the north and averages 18 inches (46 cm.) wide with a maximum of 36 inches (91 cm.) (Uglow, 1921). The western part of the vein is massive quartz containing free gold, some native bismuth, and small amounts of chalcopyrite and pyrite. The east end grades into a splay and then becomes a disconnected series of massive magnetite lenses. The magnetite carries some quantity of free gold (ibid.).

The Windpass claims were originally staked in 1915 on gold showings. From 1917 to 1930, extensive underground workings were made and in 1935, a small mill was set up and processed gold ore until 1939. Small amounts of surface work were done in 1961 and 1973. The latest activity includes drill exploration by Esso and Kamad Silver Co. (Stock Watch, 15 Sept. 1987).

REFERENCES FOR VEIN ASSOCIATED MAGNETITE DEPOSITS

Alcock, F.J. ; 1930 ; Lead and Zinc Deposits of Canada ; Geological Survey of Canada, Economic Geology Series No. 8

Minister of Mines, B.C. ; Annual Reports ; 1892, 1900, 1924, 1925, 1927, 1929, 1962, 1963, 1966

Schoefield, S.J. ; 1915 ; Geology of Cranbrook Map - Area, British Columbia ; Geological Survey of Canada, Memoir No. 76

APPENDIX

Other Selected Magnetite Occurrences in B.C.

These occurrences have minimal information with regards to magnetite mineralization and often the local geology as well. However, the MINFILE database records these as having magnetite, frequently associated with other minerals. Further information is available from the B.C. Ministry of Energy, Mines and Petroleum Resources MINFILE system.

NAME	MINFILE N°.	NAME	MINFILE N°.
Papex	82E SW 049	Crown	92J NE 053
Vancouver Queen	82F SW 049	London	92J SE 001
Lord Roberts	82F SW 163	Eagle, Ax	92J SE 008
Jumbo	82F SW 111	Red Jacket	92J SE 009
Cu 1	82M 138	Boulder	92J SE 010
Verity	83D 005	Smith Group	92L 037
Red Dog	92C 012	Caledonia	92L 209
Tantin	92C 038	Alexander	82M 002
Agnes 1, 3	92E 013	Highland Boy	93M 070
Thelma	92E 031	Copper Island	103B 022
Ormond	92E 033	Modoc	103B 031
Black Prince	92F 086	Reco	103B 032
Kitchener, Modoc	92F 138	Magnet	103B 034
Mountain	92F 184	Copper Queen	103B 035
Kit Kat	92F 282	Moresby Island	103B 036
Avon	92F 350	Eagle Tree	103B 037
Britton Mtn.	92H NE 010	Royal	103G 016
Fraser, Hamilton	92H SE 032	Lady Luck	103I 013
Chalco	92I NW 010	Copper Queen	103I 131
Soo, Bane, Verna	92I SE 051	Max	104B 013
Peacock, C A	92I SE 132	TP Camp	104M 048
Copper Mound	92J NE 048	TP Main	104M 049
Seneca	92J NE 049	Low Grade	104P 026

MAPS NOT

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